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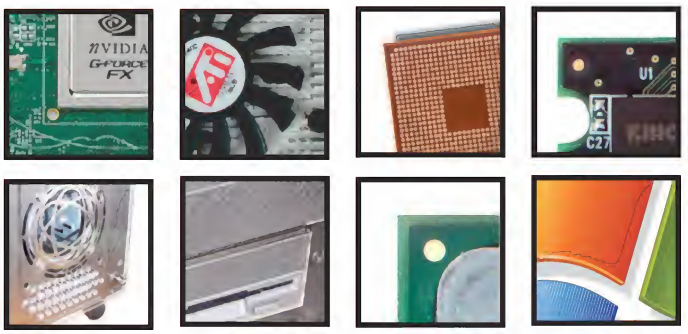


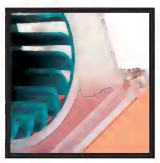


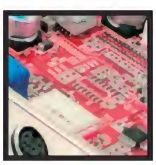



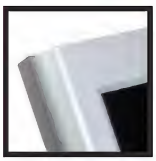


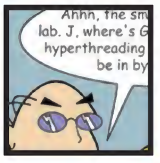

1:8571

Want to know something crazy? No? Cool, turn the page then. It's not like anyone actually reads this editorial page anyway. One day I'm going to cut and paste the first page of a *Harry Potter* novel, run it as my editorial and see if anyone notices. Pokemon (Ruby) on GBA is the best gaming experience I've had in years. Thanks for getting me onto it, Mael, mate. Anyway, what's crazy is that *Atomic* has a letters page. It's beyond crazy. It's lunacy. Magazine Publishing Science dictates that one simply must have a letters page. It's the voice of the readers. A bulletin board of opinion. A chance for praise or damnation of something we've done in the magazine. An area for people to have their say in a public forum, be it sensible or silly. It is, dare I say, simply a forum.

For the last couple of years we've printed an average of five or so letters each month. Over the lifespan of *Atomic* we've printed probably around 140 letters. One hundred and forty.

Now, let me haul out the *Atomic* Scales of Justice and do some balancing. . . the only thing in the whole universe that is identical to the *Atomic* letters page is the *Atomic* forums. Fully identical. OK, now it's time for some maths, and if that doesn't scare you into turning the page I truly congratulate you with bearing with me while I tripe on here.

One hundred and forty letters printed here, I'm putting those on the left tray of the Scales. Over the same period we've had approximately 1.2 million posts in the forums.

That's a ratio of 1:8571, and when I put the forum posts on the right tray of the Scales it instantly crashes straight through the floor, gouges a neat hole through the centre of the Earth and blasts out of the Atlantic Ocean somewhere between the Azores and Bermuda, and continues into the depths of space. Still accelerating.

So, logically, we must conclude that running the letters page in *Atomic* is pretty bloody stupid.

Who am I to argue with the Scales? So it's outta here. Radical. Beneficial, too. It means we've reclaimed at least two pages of paper real estate each month so we can run more tech-like stuff.

Wey hey! Post of the Month has been relocated to the news pages, right next to Atomican, which seems to us to be remarkably sensible, as well as slightly crazy. In a sensible, crazy sort of way.

What's also sensible is our revamped Scanner section. We were going to name it GameTechNews, but rightly realised that it was a stupid name and Scanner is way cool. Hope you like it.

Have a great month everyone, and do enjoy what we think is one of the coolest issues of *Atomic* we've yet done.

Ben Mansill
Greeno

Cover illustration by Tim McPherson

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MAXIMUM POWER COMPUTING

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SHORT CIRCUITS

With the kafuffle over with, Futuremark has done a bit of work on 3DMark03, however most of the changes are in reaction to the release of DirectX 9.0a.
The benchmark is now up to build 320, and along with some bug fixes there are a couple of new features, including the option to force 1.1 pixel shaders in the second and third game tests and custom model tools. Users have also reported slight higher 3DMark results.

Who'd of though Dell would realign its sights on the enthusiast market? Not happy with kicking into the PDA world, the global OEM system builder has released its Dimension XPS, a snazzy blue number with a flashy bit of silver on its front.
It has a 3GHz P4 and an 800MHz FSB-capable mobo (i875P), so we can't complain. But somehow we don't think there'll be 'enthusiasts' lining up to buy it. . .

You'll have to wait for it. Yeah, we're not going to tell you until the end of this short circuit. Sure, you could just skip straight to the last sentence, but you'd miss out on this terrific textual tension. Okay, okay. . . so, what is it then? We'll there's a new game out – just let your mind fog and your eyes glaze, and see what you make of the name Furious Karting.

With Barton a sealed deal, AMD has rolled out its higher-speed chips based on this core. The Athlon XP 3200+ was launched on the 14th of May, and supports a 400MHz FSB, rather than 333MHz. But with the 800MHz FSB Pentium 4 upon us, AMD will need more than the trusty 32-bit Athlon to compete.

Cash-padded Cell

Intel beware – there is a group of companies developing an architecture that's set to revolutionise the way we think about processors. Surprisingly enough, AMD has absolutely nothing to do with this group – yet. Instead it's the exceedingly clever bunch at IBM who are the driving force behind this new architecture, and it's teamed up with everybody's favourite manufacturer of portable music devices – Sony. Toshiba have also joined these corporate behemoths, leading to a partnership that probably has Intel waking up in the middle of the night, screaming for mummy.

This group isn't new, and was formed back in 2001, but Sony's recent investment of US$1.7 billion over three years towards the fabrication of this new chip shows that these players are serious. It has also been recently announced that this architecture is nearing tape out phase, indicating that production of the chip isn't far off, with first working samples expected in 2005.

The architecture is known as Cell, and instead of trying to make ever more powerful processors running at ridiculously high frequencies, Cell sidesteps around these problems with a rather simple solution – multi-processing, or more accurately, a System-on-Chip (SOC) design. Instead of relying upon a single processor to shoulder the burden of a system's processing tasks, Cell will have multiple processor cores on a single die – probably around 16 or so, although less demanding applications could have as little as four. These general purpose processors will be dynamically allocated to different tasks, such as sound or video processing, depending on what the CPU is required to do at the time.

The problem with this is that the bandwidth requirements between each core on the die will be phenomenally high – much higher than current bus technology can provide now or in the near future. This could well be the biggest hurdle the Cell designers must overcome. It must be noted that Cell isn't the first processor to use this SOC design – IBM's Power4 used two PowerPC cores on one processor.

The other main strength of Cell is that, theoretically, different devices with Cell chips can share Cell resources. So if you're playing on your Cell-powered gaming console and want to unlock even more detailed graphics for your games, you can simply plug in your Cell-powered HDTV or MP3 player to get more processing power. Again, bandwidth between these devices is going to be a giant hurdle, and must be overcome quickly for this technique to work. Thanks to the 300 whiz kids who are locked away in IBM's labs working on this architecture, Cell will have some of the most cutting edge features yet seen in a processor, including copper wires, SOI (Silicon-on-Insulator) transistors and low-K dielectric insulation – the sort of technology NVIDIA is using in its GPUs (GeForce FX) and AMD in its CPUs (the Opteron and Athlon 64 use SOI). Unfortunately there hasn't been any mention yet of the frequency these processors will be launched at, but IBM has said that the Cell architecture will lead to 'consumer devices that are more powerful than IBM's Deep Blue supercomputer'. Besides, frequency is likely to be meaningless considering Cell's design, but it will be interesting to see what sort of rating scheme the group comes up with. According to those involved with the manufacture of Cell, it will be capable of delivering one trillion operations per second (one teraflop) – approximately 100 times faster than a 2.5GHz Pentium 4. Although we're taking these last comments with a 3kg nugget of sea salt, we're still looking forward to the day Kasparov gets his arrogant butt kicked by a Sony DVD player. Cell will be manufactured on a 0.065 micron process – half the size of the process currently used by both AMD and Intel, who are only just now etching Silicon at the ever-so-tiny 0.09-micron manufacturing process.

There have been various rumours on the Net about Cell being used in the PS3, so we thought we'd contact SCEE. According to Nick Sharples, Head of Corporate Communications, 'It has been announced that the next generation PlayStation will use the Cell chip, but it has not been announced that this would be called PS3 – it may or may not!' So the comments about Cell not making it into the next PlayStation seem to be unfounded, but there is no firm release date for the next PlayStation. Considering Cell isn't expected to go into mass production until 2006/7, it could be quite some time before we start playing Cell-powered games. If Cell does manage to deliver on its promises, we might see Moore's Law blown out of the water, with a performance increase of a magnitude unimaginable by today's standards. And with the ability of Cell to be installed in a variety of products, from servers, to PCs and MP3 players, Intel might finally have something to worry about.

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AUS EGAMER

This month saw the inaugural running of the Pantheon Cup, a new LAN competition held in conjunction with SGL. After some fierce gaming over the two day event, clan 'exhale' came away the winners.

The Melbourne CS community came together this month for the massive MGL tournament. With support from Cyberage.1337, one of Melbourne's top gaming rooms, and the entrance of some of Australia's top teams, the competition has been hard hitting. Visit www.auspantheon.com or chat on irc.enterthegame.com #p for the latest news.

A meeting of nations in NZ this month as Auckland played host to the Cyberally Games. First prize of $NZ10,000 was too sweet a deal for Australia's top players to pass up. Teaming with NZ friends, Auspantheon front man Kalgo formed ANZAC. The team came second taking home $NZ5,000. NZ showed it has some serious talent with its premier team 'parallax' proving itself too tough for the competition.

The big word of the month floating around the forums was instability. After reforming old-school clan Ultrix, Kosheen jumped ship to Everglide quitting soon after.

By far the biggest news was the disbanding of Melbourne-based UI (Unknown Individuals). One of the strongest lineups yet seen in Australian competition, start man Hyper moved to team Everglide, subsequently deciding to call it a day. The future of famed player Lemming in doubt for scant hours, snapped up by Everglide also. By recruiting top players Everglide now looks set to win MGL easily and are determined to dominate the national LAN stage.

Embedded upgrades

Welcome to the era of the reverse paper launch. One of the companies notorious for lengthy gaps between release date and actual product delivery, NVIDIA, has surprised us all by launching a new product that's been shipping since February. The product in question is nForce2 Ultra 400, a tweaked-up version of the nForce2 with official support for AMD's new 400MHz frontside bus.

The chip has already appeared from several manufacturers as a slight version revision, such as ABIT's NF7-S version 1.2 or ASUS' A7N8X Deluxe version 2, which will magically turn into nForce2 Ultra 400-based boards with BIOS flashes and driver updates. The reason behind this move is that NVIDIA redesigned the nForce2 SPP late last year to improve support for DDR400 and the 400MHz FSB; however AMD's launch was not to be seen for several months later.

So NVIDIA shipped the new chip and has waited until AMD's launch of the Athlon XP 3200+ to announce the new branding, with the nForce2 Ultra 400 aimed at the enthusiast with its use of dual-DDR, and the nForce2 400 destined for the masses, thanks to cost savings made possible by only using single-channel DDR technology.

Could it be that NVIDIA is suffering the same problems that have plagued Australian tennis for many years; namely the inability to dominate both streams (male and female) of the competition at the same time? NVIDIA is finally going from strength to strength with its platform processors as its graphics cards take second place to ATI's.

Also of note, ATI should soon launch it's new RS300 motherboard chipset for the Pentium 4, which will not compete directly with nForce2, but will definitely put pressure on it as enthusiasts weigh up Athlon-based nForce2 platforms with Pentium 4-based RS300 ones.

atomican

We've finally done it! After two successive defeats at the hand of the OCAU gang, Team *Atomic* has triumphed over our honourable foes and squished their bodies into teensy tiny giblets (www.atomicmpc.com.au/forums.asp?s=1&c=1&t=7812). Despite a loss in the Counter-Strike round, categorical conquests in Quake 3 and BF1942 secured the win and the champions' cup of much shininess. Although OCAU holds the overall lead of 2-1, this success marks the start of a glorious era of *Atomic* domination!

Following in the tradition of other great help guides in the forums, KGB has decided that a similar resource was needed for all the Dremel junkies of *Atomic*. Thus he has started the Unofficial Atomican guide to case modding (forums.asp?s=2&c=18&t=38). With just about everything from choosing the right case, to putting an exorbitant amount of fans in your pride and joy, it is a great resource for those thinking about modding, and even for the hardened veterans.

In a display of shameless violence, Darrkon has posted a shocking video that can only be described as 'When Heroes Go Bad' (forums.asp?s=1&c=1&t=9621). The Rodney King case doesn't come close to this. We're just pleased that the devilish Boots of DDR +4 were not used to inflict more pain on the victim.

The time has come again for bruising, welts, and general bodily harm. *Atomic* Paintball is on again and the misty moors in August is the time set for the battle (forums.asp?s=1&c=5&t=137). Only on the fateful day will we be able to separate the men from the mice (and the SuperiorGoddesses).

For all the *Atomic* bachelors out there (and I'm guessing there's quite a few), el gringo schlong Funnelbc has begun a new series of living guides to help us out (forums.asp?s=1&c=1&t=9605). The first how-to guide gives step-by-step instructions on how to dispose of food that has gone just a bit past its use by date. With pictures and all, it is an invaluable resource.

And just as a reminder, if you take both the blue pill and red pill, you wake up in your bed, but you keep falling down a rabbit hole.

POTM 29

Not since Robin Williams got his kids to stand on their desks have the words 'education' and 'triumph' been used together. chasper7's tale of lucky luck is so improbably it's heartwarming.

Because it's true.

Well, it better be chasper7 –or we're going to want the lovely Logitech MX500 you've won back. . .

Just kidding there, of course we believe you! Didn't mean to scare you. Truthfully.

Anyhow, top work there. Go chasper7, go *Atomic* and go the mighty education system!

www.atomicmpc.com.au/forums.asp?s=1&c=1&t=9287

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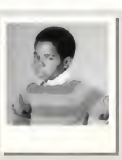

- FX 5200 – Still climbing the stairs
- Gary Coleman – Undelightfully short
- Lorikeets – Loud and annoying
- Big Brother – Fight to be noticed
- KIA – Coffin anyone?

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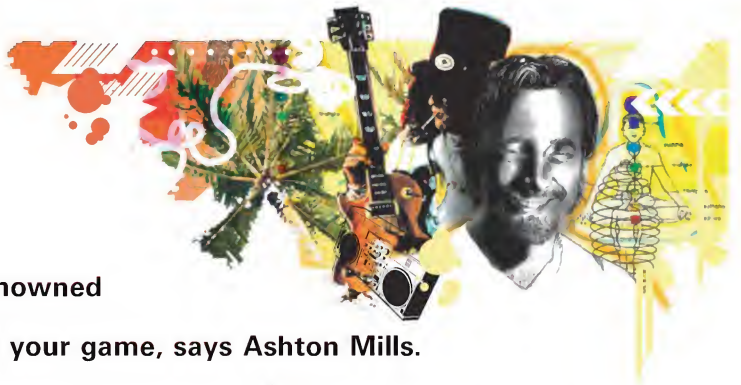

Of bridges and bytes

So you complain when Windows displays its renowned blue screen of death? Be thankful all you lose is your game, says Ashton Mills.

Atomicans, and computer professionals in general, often enjoy bitching about the quality of software we come across in our work and play. We feel that our experience qualifies us to pass judgment on a product when it fails to meet our expectations, especially when we happen to experience a loss of time or effort first hand.

No one's a happy chappy when they lose something courtesy of a crash.

Mostly, though, it's just a healthy venting of frustration at software and an industry that, in our minds, really should be performing at a level above what we are currently experiencing it. Enter blazingly obvious target number one – Microsoft. We all like to bitch about Microsoft, wondering just why it is that Windows isn't as uber-stable as we think it should be. Come on Microsoft! You have the raw dough to buy a small country and a case a beer for each member of its population, surely you can spend the cash to properly debug your own software?

'Also In 1997 the USS Yorktown was left 'dead in the water' off the coast of Cape Charles after a divide by zero error in the Windows NT system automating its propulsion.'

But in truth, we have it good. The most we lose when our systems chuck a BSOD on us is that essay due tomorrow. The fact is almost all software has bugs. Microsoft can't get rid of them all, nor can the Unix vendors and the various Open Source movements. The problem, however, is that out in the big wide world there are certain applications where there just isn't any room for bugs.

Take the following:

- In 1962 an error in a FORTRAN statement, a missing hyphen to be precise, caused the Mariner I probe destined for Venus to veer off course, necessitating its destruction to prevent it crashing into a populated area and killing a whole bunch of people.
- In the Falklands war a British destroyer, H.M.S. Sheffield, was sunk because the ship's radar warning systems identified an incoming Exocet missile as 'friendly'.
- In 1983 the Soviet Serbukov-15 base falsely indicated incoming ICBMs enroute to Moscow, human intervention prevented automatic retaliation.
- In 1988 the Soviet Phobos I Mars probe was lost, due to a faulty software update, at a cost of 300 million rubles. Its disorientation broke the radio link and the solar batteries discharged before it could be reacquired.
- The Dallas/Fort Worth air-traffic system began spitting out gibberish in the fall of 1989 and controllers had to track planes on paper.
- In 1997 Korean Airlines flight KAL 801 crashed in Guam killing 225 out of 254 aboard. A worldwide bug was discovered in barometric altimetry in the Ground Proximity Warning System.
- Also In 1997 the USS Yorktown was left 'dead in the water' off the coast of Cape Charles after a divide by zero error in the Windows NT system automating its propulsion.
- The hole in the ozone layer over Antarctica was left undetected for eight years because data was treated as anomalous by software that considered it out of the specified range.
- A software upgrade glitch resulted in the New York Stock Exchange being unable to trade roughly half of its stocks in the morning of 8 June 2001. Consequently, the exchange was shut down entirely (on grounds of fairness).
- Three Special Forces soldiers were killed and 20 others injured by friendly fire in Afghanistan in December 2002 when a GPS battery changeover reset the Taliban target confirmation to its own location.

And we think we have it bad? The examples here are but a snippet from the Software Horror Stories page (www.cs.tau.ac.il/~nachumd/verify/horror.html) and RISKS digest (www.risks.org). The RISKS digests are particularly interesting, detailing the sometimes disastrous impacts of technology around the world.

A massive summary of these digests titled *Illustrative Risks to the Public in the use of Computer Systems and Related Technology* can be found at www.csl.sri.com/users/neumann/illustrativerisks.html.

It's a bit of a wake up call. Computers and the software that drives them are an integral part of our society and infrastructure, spanning every single area of our lives.

Human beings just happen to be fallible, and so then are our creations. We have to expect errors will creep into the software we design and that the most damaging bugs will be those we don't expect, can't predict, and always fail to foresee.

When asked why we can't build software the way we build bridges, Richard Gabiel, a distinguished software engineer at Sun, responded 'We've been building bridges for thousands of years. . . we've only been building software for fifty.' It's a fair point, but will we ever been able to produce bug-free software? Even as we refine the art of program development, our demands of technology evolve and with them complexity. As software becomes more intricate the chance of errors being built-in starts to grow exponentially.

Until we can teach computers to write perfect code, our mushy-brained error prone abilities will have to do, which means bugs are always going to be part of the package.

Dare I say it – but next time you get a BSOD, be *thankful!*

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The path of fate to be

AMD's x86-64 is forging a path into the future that Tim Dean finds himself strangely compelled to follow.

It's a new era of computing. A new paradigm. A new age. A new epoch. A new hyperbolic adjective.

It's all about moving to the next generation. About throwing off the shackles and limitations of the last. We're talking bigger numbers, higher speeds, more memory, better graphics and a far more advanced architecture to drive you into the future.

That's right, I'm talking about the 386! Phwoar. . .

16-bit computing is for monkeys. It's old hat. 32-bit is the way of the future. 16MB of RAM is just not enough to run the high-power applications of today. The 386 opens up an amazing 4GB of memory! More than you could ever possibly need!

And what's more, with the new 386 processor, you can still run all your old 16-bit applications without any performance loss.

At least, this was the case according to Intel in 1986, when the 386 was launched. Back then, there was plenty of hype and hyperbole about what 32-bit processing could accomplish, and how it would change our computing experience, and for the most part, it came true. The only catch was – it took about another six to eight years for many parts of the 32-bit 'future' to catch up to the marketing talk of the 386 launch.

It wasn't until OS/2 Warp and Windows 95 were launched that 32-bit computing came to the masses, and even then a great number of applications were still 16-bit at their heart, and didn't take advantage of 32-bit technology. Windows XP Home Edition can safely be called the first popular mainstream consumer operating system that is fully 32-bit, and XP Home only arrived in 2001 – a full 15 years after the launch of the 32-bit 386!

Which brings me to today. Last month saw the launch of AMD's Opteron processor, its first venture into 64-bit territory. I won't bother recounting the promotional guff that was spouted by the marketing gibbons at the launch – it wasn't really that much different from the stuff above from the 386 launch. But the Opteron, and AMD's AMD64 (x86-64) architecture parallels the 386 in many ways.

Unlike Intel's Itanium range, which is fully and unadulteratedly 64-bit through and through, the Opteron (and the upcoming Athlon 64) is both 64-bit *and* 32-bit compatible. So, while Intel might be thinking it'll be another 15 years before we have a decent consumer 64-bit operating system, so it's safe to stick with the 32-bit Pentium 4 for now, AMD is banking on the same logic that went behind the 386 – that there will be a demand for both 64-bit and 32-bit at the same time.

So, what can we, the users/gamers/tinkerers/non-server IT managers get from 64-bit computing today?

So, what can we, the users/gamers/tinkerers/non-server IT managers get from 64-bit computing today? Not much is the short answer.

First off, to get anything interesting out of real 64-bit processing, you'll need a 64-bit operating system. There are plenty of 64-bit flavours of Linux, including SuSE, Debian, Turbo Linux, Red Hat and others, and Windows XP 64-bit Edition is here now, with support for AMD64 planned for September this year.

Then you'll also need 64-bit applications. At the moment there's a very limited number of 64-bit applications written for IA-64 and the Itanium. The ones that are around are not the kinds of things you'd find yourself running at home – assuming you had an Itanium at home, of course.

There are more for the Opteron though. A part of AMD's 'compatibility gamble' is it wanted it to be piss easy to port applications to x86-64. So far, that seems to be the case, as in the example of IBM's developers, who were able to port DB2 (all 10,000,000 lines of C++ code) to AMD64 in just two days. Now, either they are some kind of superhuman code jockeys who can stare at walls covered with code (a la *A Beautiful Mind* and make the necessary tweaks on two simultaneous workstations – one for each hand – without eating, drinking or blinking for 48 hours, or it's not that hard to port to AMD64. I think it could be a little bit of both.

And then you can experience the joys of addressing a terabyte of RAM, and you can run massive number crunching exercises, like modelling turbulence, or running thousands of titanic database searches, or something equally exciting to do on a Sunday afternoon.

Thus, short answer: not much. . .

But then again – with the Opteron and Athlon 64, you can still run 32-bit applications. Ah, AMD. Genius!

The Opteron and Athlon 64 have a couple of features that make them very desirable processors just for running the same old malarkey we're running at the moment – all in 32-bit. They have more registers than the Athlon XP, which means they are more efficient in dealing with memory in some operations; they have an integrated memory controller (or Northbridge), which results in faster and lower latency memory access; they have 1MB of L2 cache; a longer pipeline and better predictive abilities than the Athlon XP; and finally they make use of the high-bandwidth HyperTransport bus, meaning faster access of other components.

So even running plain old 32-bit Windows and 32-bit applications, the Opteron and Athlon 64 are highly desirable. Initial testing seems to indicate a 1.8GHz Opteron can hold its own with a 3GHz Pentium 4 in many gaming-related tests. As gaming is very memory and bandwidth intensive, the architectural improvements to the Opteron make it a bit of a killer in the 32-bit department regardless of its 64-bit performance, which is pretty academic for us at this stage.

We'll have to wait until we can get our hands on some processors, and nForce3 boards with AGP, before we draw final conclusions, but it's seeming to be more and more likely that we'll be recommending you head out and grab an Athlon 64 and forget it even has 64-bit capabilities. Just plug it into Windows XP Home or Pro, and game away. It's the way of the future.

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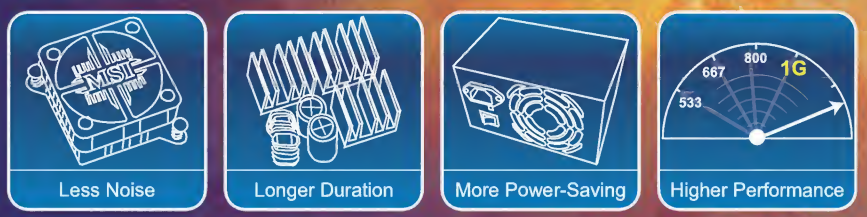

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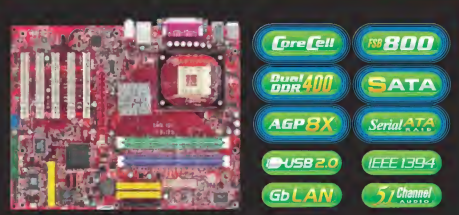

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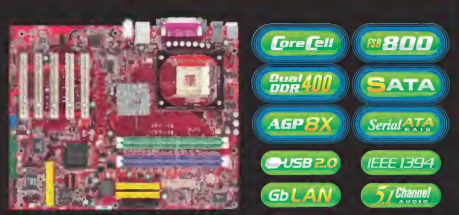

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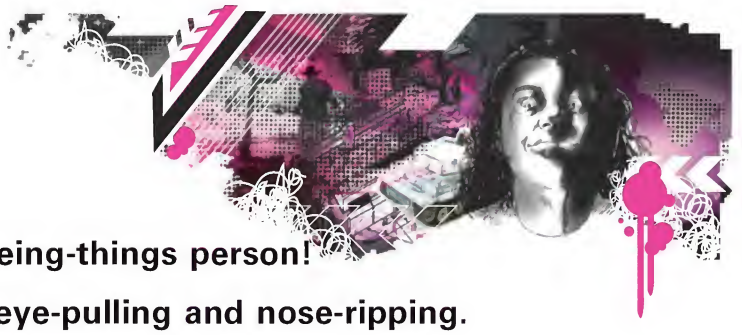


Making wires invisible

Have you seen those interfaces? Bad seeing-things person!

Now, help Dan Rutter and go do some eye-pulling and nose-ripping.

In last issue's column, I rambled on about technology that becomes ubiquitous and invisible.

I left out one biggie, though.

Wires.

Go and look down the street of a major city. You'll see cars and buildings and people, but if you're a typical city-dweller, it may take a conscious effort for you to notice the black cables festooned from poles everywhere.

Still, don't expect these particular ubiquitous pieces of technology to disappear any time soon.

The number of cables our utility poles have to support has dropped over the last few decades, but it's now about as low as it's going to go.

Many of the wires that are used for data – moving it from device to device, or around within the one gadget – are already being replaced by better technology. Radio communication gets rid of the cable; optic fibre massively reduces the number of cable strands needed for a given amount of data bandwidth.

Data processing is still pretty much all electronic – so don't hold your breath for optical CPUs. But optical data transmission from place to place is now the rule, not the exception.

It's now quite difficult to telephone anybody anywhere in a developed nation without your voice being turned into photons for part of the journey.

Most of the cables still strung around cities today, though, aren't data wires.

Here in Australia, thick cables strung low on the pole are probably for cable TV, but the thinner wires further up carry power. You can't run your toaster from an optic fibre.

Strung power wires are basically made of Aluminium. A cable of a given thickness made from Aluminium isn't as good a conductor as one the same size made from Copper, but by *weight*, Aluminium's more than twice as good. And weight is very important when you're hanging wires from poles.

As urban power demands rise – and they *are* rising, despite our best efforts – the power transfer capacity of the electrical grid has to rise too.

That means larger transmission towers for the long cable runs, with thicker cables (for more current capacity), held further from the towers (for more voltage capacity without arcing).

The more power you want to move, the bigger and uglier and more expensive all this stuff gets. You also start striking problems like finding room for extra suburban substations.

Power wires can be run underground – and some already are. But doing that requires a lot of conduit space and a surprising amount of cooling – that's because of resistance.

> 'Microwave power either has to use narrow high energy beams that are a very severe health hazard for any living thing that cops one in the giblets, or wide low energy beams that need gigantic receiving antennae.'

Power cables aren't perfect conductors, so they turn some of the electricity passing through them into heat. That means they need to be cooled if they're located underground, and it also means that they have to be rather fat if they're to transfer a lot of power, even if it's at very high voltage and thus relatively low current.

Resistanceless materials – superconductors – look like a very good thing in comparison. Up to a point, a superconductor has literally *no* electrical resistance. No power is wasted as heat, and a very large amount of electricity can be pumped through a quite small conductor. And we can make cable-ish things out of high temperature superconducting material now. They're being used in some trial power transmission projects already.

Again, resist the breath-holding feeling, as you won't see them in your neighbourhood in the near future because 'high temperature', in this context, still means 'cooled by liquid nitrogen' – and *room* temperature superconductors remain quite a long way off in the future.

Cryogenic superconductor cables let city-level power supplies be routed through relatively small conduits with near-zero loss, but they're hardly user-friendly. They're prize bastards to repair, for instance. Before you can even *start* a repair job on a cryo-cable you have to wait for it to warm up; after you've finished, you have to cool it down again before it can be put back in service. The cool-and-warm cycle can take *weeks*.

You can't, in case you were wondering, beam domestic power through the air. Once again, *data* can be broadcast or narrowcast with relative ease, but power just can't.

Microwave power transmission is quite practical, provided you have line of sight and it isn't raining.

But it either has to use narrow high energy beams that are a very severe health hazard indeed for any living thing that cops one in the giblets, or wide low energy beams that need fairly gigantic receiving antennae.

This latter solution could work if we ever build solar power satellites and need a way to get the power to the ground; a vast receiving antenna bathed in rather less radiation per square metre than the sun delivers at noon would be a safe way to get the megawatts from there to here.

But you couldn't fit such an antenna in your back yard.

Actually, there's a good chance that it wouldn't fit in your *postcode*.

Getting plain old suburban power cables off poles and under the ground is, at the moment, just a matter of money. Local councils that can raise the money can do it, with existing technology.

Existing technology's what we're going to have to keep using for some time, though, as non-cryogenic superconductors are still fantasy tech, and no other sensible option exists. And I doubt time travel is an option at this point.

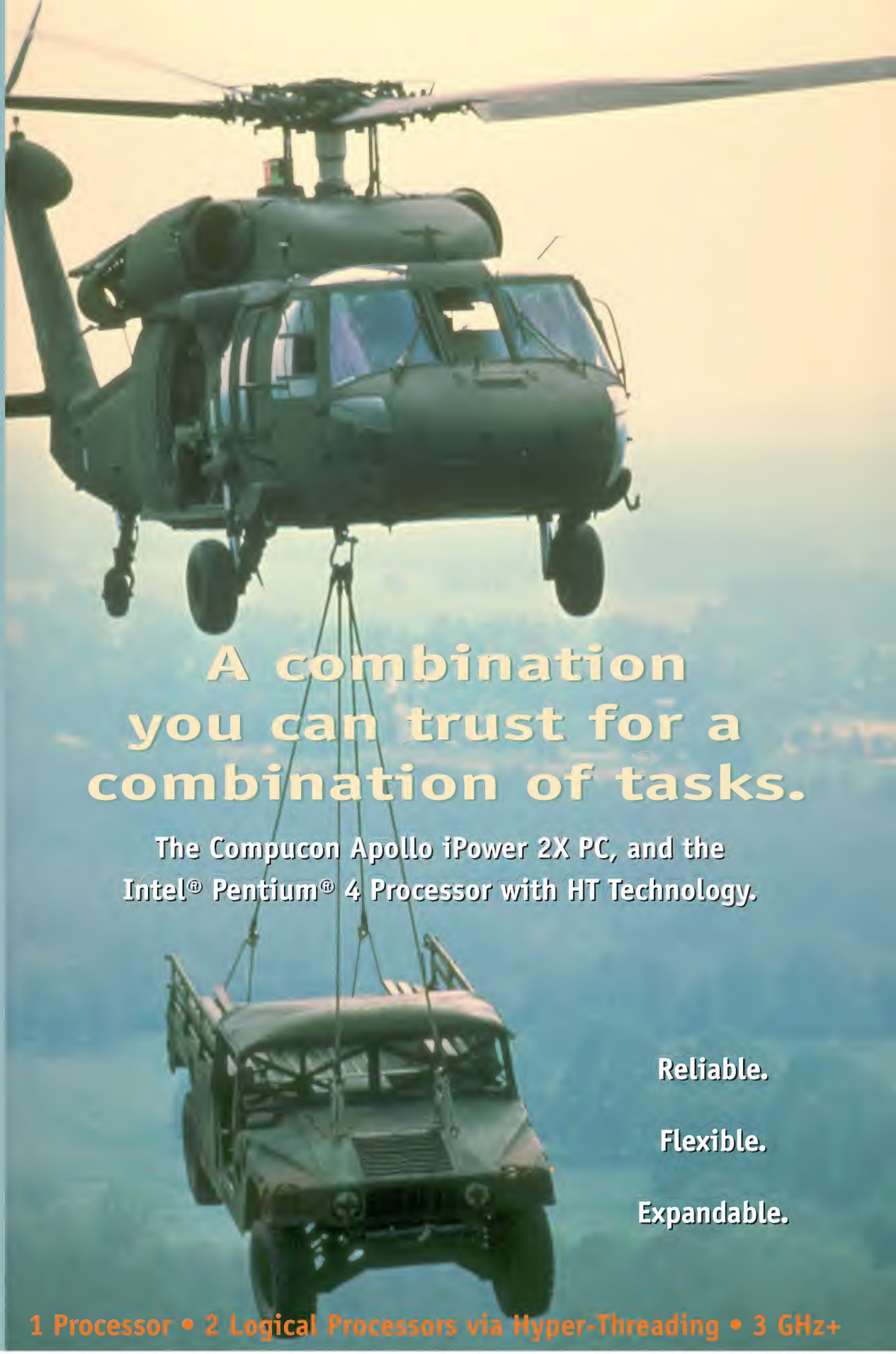
Wires inside our gadgets may turn into light guides, and most of the world's short interconnecting cables may go away.

But power wires will be with us for a long time yet.

Side Panel Air Inlet

Passive Air Duct

Processor Fan



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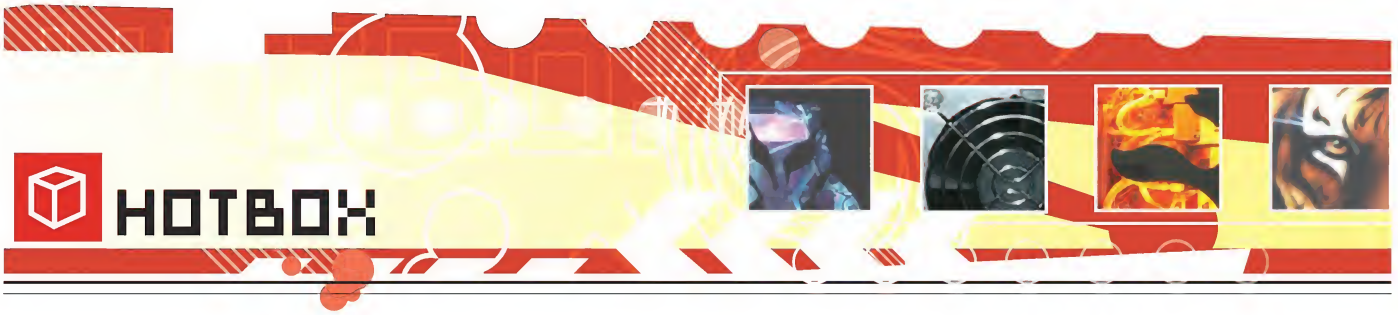


Explague's Dangerbox

Technical details

- AMD Athlon XP 1600+ @ 1.8GHz
- Soltek SL-75DRV5
- 1GB DDR333
- Two Seagate 40GB Barracudas
- GeForce4 MX 440
- Pioneer DVD
- Lite-On 40 x 12 x 48
- Creative Sound Blaster Live!
- Hercules Smart TV
- Netcom 10/100
- Ball mouse (Very proud of this)
- Microsoft Internet Keyboard PRO
- 17in Lite-On monitor

I started my case mod roughly two years ago when I was at a LAN asking for suggestions on cooling. One stood out, as it was a joke: 'Put a huge as MOFO fan on side'. Turned out a mate had pulled parts from an old Volkswagen and gave me the radiator fan.
I sat looking at the side panel of my case for a good hour trying to work out how to mount it. Without a clue, I pulled out the tin snips and hacksaw. After three hours of cutting, sanding, grinding and drilling my case had finally taken shape and was able to hold this huge beast of a fan.
I set work on the power supply (knowing it wouldn't be able to run off the computer power supply) I got a hold of a small keg of beer. After emptying the keg (glug, glug hiccup) I removed the top and inserted a 250W computer power supply. A few holes in the side and some wiring later, I had a fan that was running off a beer keg. I finished the case off with a professional paint job by the local panel beater. Mainly dark blue,

Kurt's TrickedOutPC

Technical details

- VIA C3 933MHz
- VIA EPIA M9000 motherboard
- 3GB laptop hard drive
- 256MB PC2100 DDR-RAM
- Laptop slimline 8x DVD
- Molex 'Y' adaptor
- PCI slot riser card
- Silent 55W PSU
- DC-DC converter board
- ATX 20-pin connector
- ATI Remote Wonder
- 100MB external Zip drive
- Four-inch green cold cathode

I started building and modding cases a few years ago. I got tired of modding the same old cases so I decided to be creative and make my own. I think building custom cases brings back the life to modding because you're not limited. I was inspired by a few other PC car mods, so I decided to build in a 1/10th scale Lamborghini. I used a HPI racing shell for the body which was airbrushed a custom-mixed color-changing purple. The color changes from a subtle blue to purple. The body also has a custom pearl silver racing stripe on each side and the wing has the correct 1/10th scale 'carbon fibre' look. I used a piece of diamond pattern chrome-plated aluminum for the base. I used HPI racing chrome rims. For the base, I made spacers to raise the motherboard high enough to get my laptop HDD, PSU and slimline DVD under it. I had to use extensions to run the mouse, keyboard, monitor hookups to the back of car. I installed an ATI Remote Wonder to control my mouse for DVDs and movies.

Red Roar

Technical details
- Pentium 4 2.4GHz @ 2.7
- Gigabyte GA-8IRXP
- 1GB PC2700
- Two 80GB Seagate 7,200rpm (RAID)
- Leadtek GeForce4 Ti4400 Dual-Head
- Sound Blaster Audigy
- Phillips TV/capture card
- Lite-On 40 x 12 x 48 burner
- 450W PSU
- Four hard drive fans
- Two video card fans
- Two PSU fans
- Three case fans

Red Roar has actually been finished for almost a year now, but I sort of never got around to submitting it.

The thinking behind Red was simple – more fans! Red sports 12 in all, and two of them are Compaq Proliant 120mm server fans, moving 120cfm through the case!

I also modded the HDD mounts to allow for the dedicated disk fans.

I chose the red because it matched the home-built 15-ultra-bright LED array (Thanks Dr Dan).

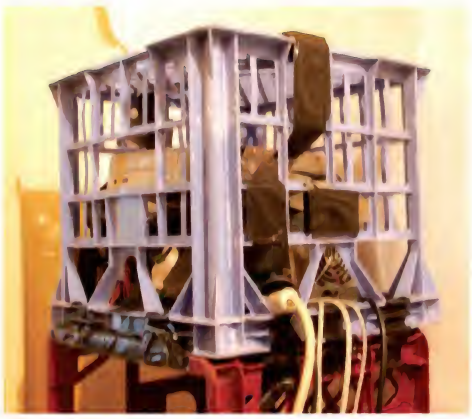
Custom cutting with Mr Dremel for the server fans front and top and the side window (dual-speed fans all round).

The alien in the window was just for fun.

Four coats of red, three coats of clear, and it's actually pretty quiet unless I crank every fan up – enough to attract attention at a LAN! wOOt!

And all it took was weekend and a stack of patience.

Thurlow Milkcrate Royale



Technical details
- Shuttle Mini-ITX motherboard
- 1GHz Pentium 3
- 256MB PC133 SDRAM
- 18GB 5,400rpm HDD
- 4x DVD ROM
- 14in monitor
- VIA integrated video
- Onboard AC'97 audio
- Two 10/100 Ethernet ports
- 300W PSU
- Assorted milk crates
- Liberal amounts of Gaffa tape
- Power and reset switches mounted

Cable Internet had just been installed and three of us needed to share precious bandwidth. Without further ado a collection was made of the flatmates second-hand parts, enough to build a system without a case. In keeping with our ghetto chic lifestyle we turned to our old student furniture friend, the humble milk crate.

Continuing with the student theme we used trusty old Gaffa tape to hold everything together, creating a sling-mount for the DVD drive and attaching the crate to the one beneath for stability (we needed to mount it high to keep it away from our psychotic cat, Stubb a Dub). We considered tying down the mass of cables, but decided they looked more in tune with milkcrate asthetics untied. Accompanying it is an old 14in monitor – you guessed it, in another crate.

Gearbox

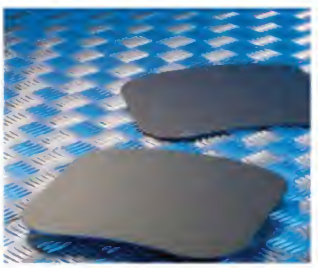
Flexiglow bubble light

SUPPLIER: Flexiglow
WEBSITE: www.flexiglow.com
PHONE: (02) 9684 6796
PRICE: $35

When the best thing neon manufacturers can come up with is a tube of plastic with lots of bubbles trapped for eternity within, it's obvious that the idea well is starting to run dry. This kit includes two plastic tubes, each with a 'Super Bright LED' mounted in one end, as well as a little transformer box and switch to change the mode. You can set them to both be lit up continuously, or to flash like a demented Christmas tree. These tubes aren't anywhere near as bright as your standard neon or cold cathode kit, which isn't necessarily a bad thing, especially for light sensitive albino gamers. At only $35, this is one of the cheapest light kits you can get for your PC.

Steel pad

SUPPLIER: Innovision
WEBSITE: www.innovision.com.au
PHONE: 1300 785 795
PRICE: TBC



Apart from having a great mouse, a decent mousing surface to use it on is almost always as important.

While we would all love to use the chest of a naked demigod or goddess as our mousing surface of choice, it tends not to help your Counter-Strike scores in the slightest, due to the stretchy nature of human flesh.

What better surface to use than metal? It's hard, it's straight and it will last at least until the end of the Iraq conflict in the year 2017. This Steel pad isn't actually steel – it's Aluminium instead. It's incredibly flat and smooth, and as a result is very accurate – provided you use an optical mouse that likes this metallic surface.

We tried three optical mice, and only one would work, while the other two chucked a hissy fit. This is another of those mouse pads that make a yicky scratchy noise, but the inclusion of Teflon strips helps to reduce this.

SRC-3810 universal remote

SUPPLIER: Altronics
WEBSITE: www.altronics.com.au
PHONE: 1300 780 999
PRICE: $269

As an Atomican, you've probably lost your lounge room under a five-foot high stack of remote controls. Okay, so that's a bit of an exaggeration, but it's not unusual to have five or six different remotes for your home theatre setup.

While it's fun to gaffer tape all of these together to create the mother of all remotes, it's nowhere near as user friendly as having a single universal remote for all your control needs.

The SRC-3810 allows you to program the functions of all of your remotes, thanks to a little IR receiver in the base of the unit. We tried to program five different remotes – four worked perfectly while the fifth caused the unit to crash, necessitating a total reprogram of the unit.

Other than this, the universal remote worked fine, looked great, and wasn't too badly priced compared to other units.

Thermaltake ducting mod

SUPPLIER: Anyware
WEBSITE: www.anyware.com.au
PHONE: (02) 9879 5788
PRICE: $15

A noisy PC is a sucky PC – not to mention annoying. It appears that most PC builders have finally gotten over the urge to install 19 different case fans that sound like a fleet of Black Hawk's taking off.

These days we want decent cooling that's no louder than a mosquito fart, which is why products like this Thermaltake ducting mod have been designed.

This should fit on any heatsink that is capable of mounting an 80mm fan, and works by reducing the air pressure, hence the noise.

It does work, to a small degree, but also, drops the fans cooling performance a little.

But there's absolutely no denying how sexy this gadget looks.

Vantec Iceberg chipset cooler

SUPPLIER: PC Case Gear
WEBSITE: www.pccasegear.com
PHONE: (03) 9568 0932
PRICE: $21.82

Dud Northbridge chipset cooling fans are a common complaint these days – it's amazing how many we see in the Labs on brand new motherboards. Now, you can either replace your entire motherboard or just whack a new fan on it. And a custom chipset cooler is a nice way of separating your modded beastie from the million and one other wannabes. The Vantec Iceberq is a nice little kit that bares more than a striking resemblance to the old Crystal Orb. It's available in both Copper and Aluminium, and as well as the standard Northbridge cooler (which by the way won't fit on the newer Intel Canterwood and Springdale motherboards) you also score a couple of Aluminium heatsinks without fans. Where these might go we're not quite sure, but no doubt some intrepid Atomican will put them to good use. Modjitsu anyone?

Vantec Tornado fan

SUPPLIER: PC Case Gear
WEBSITE: www.pccasegear.com
PHONE: (03) 9568 0932
PRICE: $21.82

This fan is appropriately named indeed. You thought the Delta fans were loud? Well, you haven't heard anything till your ears have been beaten to a bloody pulp by this thing. However, for those who demand the ultimate in cooling performance, you'll be hard pressed to find anything that chews through the cfm like the Tornado. This little buzz box pumps a whopping 84cfm, which is guaranteed to get the air flowing as fast as the innards of a lout after a curry binge. However, you'll need to make sure your fan header can handle the 9.1W needed to power this beastie. If that's not fast enough for you, the TD9238H model pumps 119cfm of air through your case, but it requires even more power, drawing a whopping 12.5W. If you're after the ultimate in cooling, and happen to be deaf, these fans are well worth checking out.

Vantec Ez Swap HDD case

SUPPLIER: PC Case Gear
WEBSITE: www.pccasegear.com
PHONE: (03) 9568 0932
PRICE: $71.82

Mmmm. . . hot swappable hard drives are stonkingly hard core, extremely convenient and they also happen to look damn sweet. The Ez Swap from Vantec is one of the most well rounded hard drive cases currently available.

It looks the biz, and is sturdy enough to cope with the occasional drop or two.

It's one of the only cases that supports ATA133, and has a nice little 40mm fan in the back to help keep your high rpm drives at a bearable temperature.

Any old 3.5in hard drive will fit inside, and the LCD display on the front helps you to keep an eye on the temperature, which is handy but not crucial.

All in all, a very tasty product.

Mouse Bungie

SUPPLIER: Archon Computers
WEBSITE: www.gamerzstuff.com.au
PHONE: (03) 9888 3188
PRICE: $28

Don't you frickin' hate the way your mouse cord gets all bunched up when you're gaming? We certainly do – probably because we're so darn anal about our gaming rigs. In the past we've tried Blue Tack'ing the cable to the side of the monitor, wedging it under a speaker and – gasp – even tried using a wireless mouse for gaming. Not anymore. The Mouse Bungie is a very simple product. All it does is hold your mouse cable up in the air, totally removing any kinks from the cable. And we love it. After facing off against the enemy of tangled cords for years, this thing is a godsend. Sure, it costs a fair bit considering how pathetically basic it is, but it does the job perfectly.

Mil-Tech: Battlefield 2003

The military has loads of money to spend on technology, so you'd expect its computers to be gruntier than anything you're likely to get your chippy hands on – right? Dr Carlo Kopp slips under the radar to investigate.

One of the most shameless myths created and perpetuated by Hollywood is the notion that military computers are somehow much more powerful and 'hi-tech' than those employed by home users and industry.

Nothing could be further from the truth. With the exception of a handful of highly specialised digital signal and data processing systems, most computers employed in military systems are one, two, three – or even four – generations behind in technology compared with their commercial cousins.

Now the latest generation of 'digitised' weaponry is making headlines we'll explore the specialised – and in many respects very different world – of military computers and how they are *really* used.

A different world?

The world of military computing is very different from the computing environments most of us are familiar with. In the broadest sense, the greatest distinction between specialised computing equipment for military and commercial users is that military computers often need to survive in very harsh or extreme environments.

The first category of military computers is basic fixed base support machines, which are used for administrative, word processing and accounting work in standard office areas.

Such machines are no different from commercial systems, although they often must meet electromagnetic emission requirements such as the US NACSIM 5100 TEMPEST standard. While the machine might be a very ordinary PC, server or workstation, it cannot be allowed to leak Van Eck radiation from the monitor, or eaves-droppable emissions from its LAN and serial interfaces. So the Quartermaster's PC will probably be identical to the machine on your desk, but the spook's machine is likely to be the expensive TEMPEST model.

The next step up the hierarchy of environmental resilience is the 'ruggedised' military computer. A ruggedised machine is a hybrid of commercial-grade electronic hardware, packaged in a MilSpec or Military Standard (Mil-Std- in the US, STANAG in Europe) casing or chassis. The chassis will be made to comply with one or more military environmental standards and such machines are deployed in the field, or used in 'undemanding' airborne, land-mobile or naval environments.

Finally, we have military 'embedded' computers, designed from the ground up to survive in harsh environments, and fully compliant with the complete gamut of military reliability standards. These are the processors that are installed in satellites, fighter planes, missiles, torpedoes, smart bombs and other military equipment and such machines may implement commercial, or specialised military instruction sets.

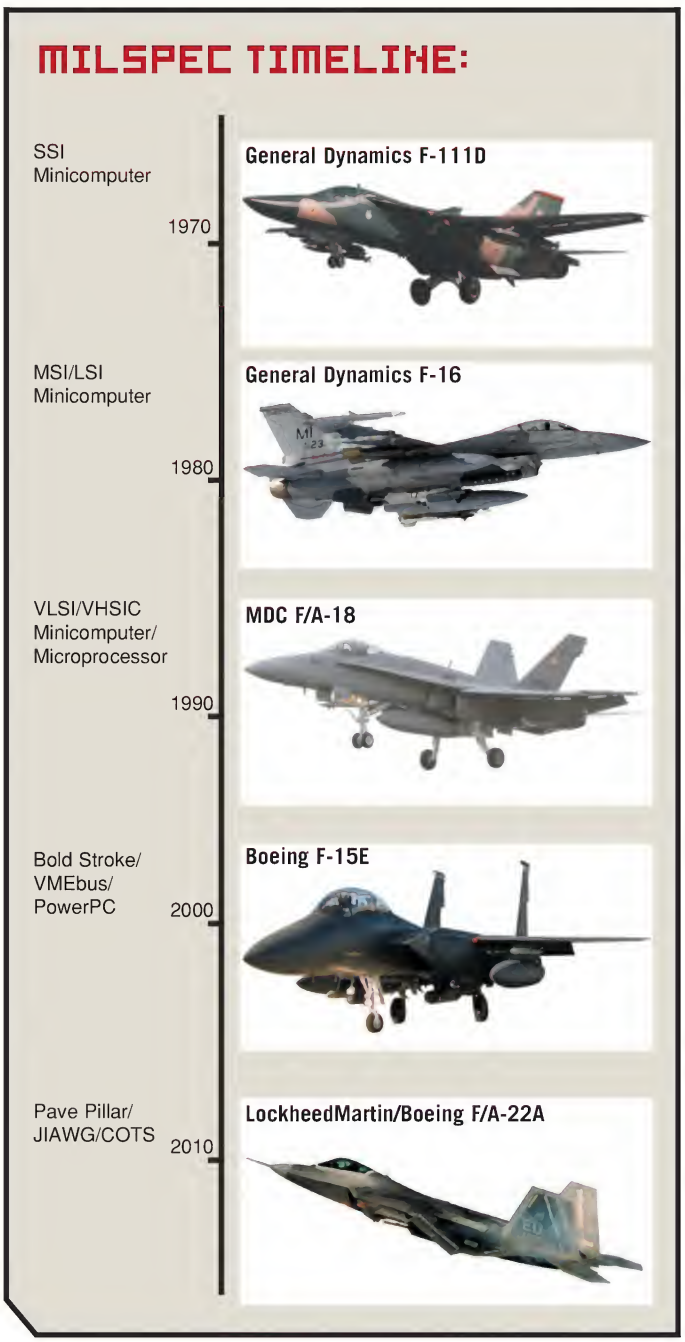
Reliability and 'MilSpecs'

The most important distinguishing feature of embedded military computing equipment is that it is designed for exceptional reliability in harsh environments – something that has had a huge impact on how such machines are designed and constructed. The problem lies as much in making the chips and surrounding hardware more reliable, as it does in measuring the reliability of such components in particular environments including the testing combinations of temperature, humidity and vibration load.

It's vital to mission success that reliability can be predicted and measured in complex military equipment and plenty of examples exist where high tech systems failed in combat because they were less reliable than they needed to be. If a missile is bearing down on you the last thing you need or want is for the 'fault' light to start flashing on the computer controlling your jamming and countermeasure equipment.

Determining the reliability of an electronic component such as a processor chip or connector can be an expensive and time consuming chore – indeed this is one of the underlying reasons why modern military equipment is often worth its weight in gold, and sometimes more!

To understand why, it is helpful to digress a little into failure mechanisms in electronic components, an area which, like basic reliability theory, is sadly no longer taught in most Australian university engineering and computer science courses. As we invest most of our engineering and computer science talent into supporting equipment – rather than designing it – this is all the more an incongruity in the scheme of things.



Electrical failures in components result typically from dielectric breakdowns in insulators, mechanical open and short circuits, migration effects in semiconductor PN junctions, and migration effects in metal. To these we can also add the insidious effects of corrosion in materials. Without delving too deeply into the materials science behind these effects, we can state that all of these phenomena are accelerated in effect by shock, vibration, temperature, temperature changes, humidity and the presence of corrosive agents left over from production.

Temperature alone can be destructive because it accelerates the diffusion of dopants in semiconductors and over a period of time this will result in semiconductor junction dopant gradients – the reason why transistors work in the first place – flattening out to the point where the junction ceases to be a junction and the component fails. High temperatures also accelerate the migration of metal between connections or chips, causing eventual short circuits.

Temperature changes cause mechanical expansion and contraction, leading to all manner of turmoil, from printed circuit board delamination, through printed circuit board holes and via connections shearing off, to pins on packages or connectors developing metal fatigue.

Vibration and shock cause straight mechanical failures, or metal fatigue. A particularly nasty manifestation of vibration is the stressful flexing of flexural modes in printed circuit boards, not unlike those on your stereo system woofer. Flex a printed circuit board enough and it will delaminate or components will start popping off it.

Humidity is sneaky in its effects: it reduces the effectiveness of cooling systems and also precipitates on components during rapid temperature changes. In turn this produces an electrolyte for dissimilar metals and production residues on components, thus facilitating corrosion.

Clearly all three of these basic environmental factors, temperature/changing temperature, vibration/shock and humidity, are damaging within themselves, and also mutually supportive in impairing the reliability of any piece of equipment. Needless to say, this is true of commercial and military equipment. The big difference of course between the two contexts is that one simply increases costs and cuts profit margins – whereas the other costs lives and battles.

When military tech goes wrong, it can go fatally wrong: in 1979, a US attempt to extract hostages from Teheran failed when the use of 'support' category-rated minesweeping helicopters designed for two-hour sorties, instead of highly reliable combat search-and-rescue helicopters designed for 12-hour sorties, caused a mission failure and loss of lives. Another fatal example was the sinking of at least one Royal Navy destroyer in the 1982 Falklands war, due to an intermittently failing missile launcher. Read Ashton Mill's *Technica Obscura* column this month for more military and civilian computer SNAFUs. When we want to launch electronics into orbit on a satellite, we also have to take into account the highly destructive effects of ionising radiation, which increases defect density in semiconductors to the point where they eventually break down.

The simple consequence of these factors is that the harsher the environment, the less reliable any given type of component. If we wish a component to exhibit a certain level of reliability in a very harsh environment, we have no choice other than to alter its design and/or packaging to accommodate.

Rated 'M' for military

The harshest military environments require chips in metal can or ceramic rather than moulded epoxy packages; gold plated pins on packages and connectors; no or few socketed chips; surface-mounted passive components; chemically-sterile manufacturing environments; and extremely tight quality control and testing.

To be really certain, once the device is made and passes its basic electrical tests, it is then stress-tested at an elevated temperature to weed out the devices with incipient failures. At the end of this arduous process, we have the MilSpec-rated version of whatever chip we started out with, including a hefty bundle of test reports to attest to the fact that the chip indeed meets the MilSpec in question. This is also why a MilSpec-rated version of a commercially used chip costs several times more – and why fudging test reports was a lucrative business that landed more than one defence contractor behind bars.

The military reliability standards were developed by the US DoD during the fifties and sixties, in an attempt to produce standard engineering guidelines for the construction of equipment, electronic and mechanical, which could provide known and predictable reliability performance in harsh temperature, humidity, shock, vibration and radiation environments, and would employ standard interfaces and component packaging.

Many standards now regarded as common in the computer hardware industry, such as the JEDEC chip-packaging scheme, are essentially US military standards.

The US MilSpec standards are enormous, by any measure, and rival or exceed in complexity many if not most industrial specification and standardisation schemes. Any standard you can contemplate, a MilSpec probably exists for it, produced at some stage during the last forty years. Whether it is gasoline, hose fittings, paint composition, chip packaging or machine instruction set, there is a MilSpec for it. The MilSpecs that are most important from a general computer industry perspective are those that cover the areas of component packaging and reliability versus operating environment.

What the US MilSpec and NATO STANAG systems provide is a standards framework for manufacturing, testing, verifying and measuring the reliability of electronic components, and tabulated reliability data for standardised devices.

Essentially the MilSpec system divides operating environments by their degree of harshness and provides cross reference tables which specify the failure rates of chips and passive components, depending on their environmental rating, type and operating temperature

In this manner, a designer can calculate the failure rate of a board full of chips, or a box full of boards, or a system full of boxes, knowing the MilSpec rating of the components used and the operating environment. The design engineer's bible is called *Mil-Hdbk-217E*, which is essentially a compilation of such tables, periodically revised to include new devices.

MilSpec under fire

The MilSpec system has been much maligned in recent years, the common accusation being that it results in 'gold-plated' equipment which is often several times as reliable statistically, once in service, than it was originally calculated to be. The upside however is that in service maintenance costs are often well below calculated expectations – a major benefit if you are operating fleets with dozens or hundreds of systems.

Another criticism of the MilSpec system is that the accumulation of a sufficient statistical reliability database for any new component is time consuming and very expensive, as a large batch of components must be tortured to death in a cyclic test environment emulating the MilSpec environment rating. It can take months or years until sufficient data is accumulated to satisfy the statistical confidence criteria – as a result, the MilSpec version of the commercial chip may not ship to customers until several years after commercial clients get it.

Moore's Law being what it is, this results in an exponentially growing gap in performance between cutting edge commercial processors and their respective MilSpec re-implementations. Thanks to the three-year gap between the commercial and MilSpec variants of a chip there is a roughly three-fold difference in clock speed. The stores management computer on the RAAF's Hornet fighters for example, was delivered during the mid eighties, which was the period of the 386/387 combo in commercial desktop computing, but the Hornet used a MilSpec-rated Intel 8080 and AMD 2900 bitslice processor in this box.

The emergence of ruggedised military computing equipment is a direct reaction to this effect, as a ruggedised chassis is designed to provide a box that isolates the 'soft' commercially-rated components from the 'harsh' military operating environment, yet still provides a system that is competitive in performance and price with commercial equipment.

DIGITAL BOMBS:

The latest generation of smart bombs is digital – the best example being this Boeing GBU-31 Joint Direct Attack Munition (JDAM), of which thousands were dropped on Afghanistan in 2001 and Iraq this year. The JDAM uses inertial guidance with a GPS receiver to improve its accuracy and a CPU in the bomb executes the same style of Kalman filter navigation algorithm as used by flight management systems in airliners. The JDAM is connected to the launching aircraft via a Mil-Std-1553B bus, embedded in a Mil-Std-1760 weapons station bus, and appears to the aircraft's mission computer not unlike a removable peripheral on a bus.

Before it is released, the bomb and aircraft repeatedly communicate to exchange status information – once a target is chosen the bomb is programmed with coordinates, trajectory and satellite parameters and released. Completely autonomous, the JDAM will then fly itself to impact. The US fleet of Boeing F-15E fighters, this example dropping five one tonne JDAMs, is being retrofitted with VMEbus PowerPC processors.

The drawbacks of ruggedised machines are size and weight, as armour plating a Pentium, Athlon, SPARC, Alpha or SGI system requires a solid package of metalwork, vibration dampeners, excess cooling and a MilSpec power supply. Therefore, ruggedised is only a partial solution to the problem, but one that is often more than adequate. Systems on ships, large surveillance aircraft, mobile command posts and surveillance systems can often be implemented as ruggedised equipment as the volumetric requirements and environment permit it. The computers packaged into tanks, missiles, torpedoes, combat aircraft, guided bombs and satellites alas still have to be built from the ground up to a MilSpec rating, because the weight, volume, cooling and radiation shielding needs of commercial components are not compatible with the packaging and environments of the system.

Interfaces, architectures and software

While the reliability and environmental challenges of the military environment are by far the most unique and demanding aspects of military computing, they are not the only ones – over the last two decades military users have developed a unique package of standard interfaces, architectures and software tools, especially to support embedded systems.

The origins of unique interfaces go back to the late sixties and seventies, when the US military fielded the first generation of fully digital weapon systems on ships and aircraft. At this time, the commercial computing world was firmly wedded to the proprietary interfaces that often plague us today as legacy systems. Common interfaces are pretty much a requirement from the outset to integrate a large number of embedded digital systems into a single interoperable package, often common across several types of aircraft, missile, ship or tank. So a number of standard busses were defined. The most important of these is the 1Mb/s Mil-Std-1553B bus, analogous in many respects to the commercial Ethernet precursors of that period.

The big difference was that the 1553B bus uses much higher signalling levels to withstand much nastier noise and interference levels, and it uses a centralised protocol model rather than a decentralised collision detection model. In realtime embedded systems, response times have to be very predictable and a collision detection bus isn't the best way for achieving this. The 1553B bus is the dominant connectivity standard for military embedded systems today, and is used to interconnect computers, sensors and weapons. Its drawback is poor throughput, which is often worked around by dedicating multiple busses in the equipment. Instead of a common shared bus, the main computer has multiple bus interfaces and a bus to an individual black box.

The success of the 1553B standard is attested to by the fact that it was adopted by ARINC – with modifications – for commercial avionics, and also copied by the Soviets before the USSR collapsed.

Built to MilSpec?

Machine architecture is another area of uniqueness in military equipment, and one that has created much debate over the years. In the early days of digital military equipment, it was customary to take an existing commercial minicomputer and manufacture it to MilSpec standards, using ceramic and metal packages, and other unique parts – such hardware met reliability needs and ran the same sort of software as its commercial siblings.

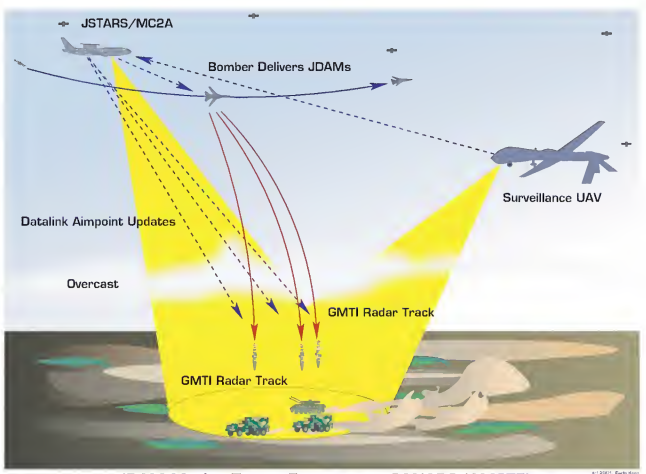
During the 1970s this blissful state of affairs went into meltdown when the military ended up with a genuine Babel of 'legacy' machine architectures to maintain software on. With much of the code written in machine-specific assembler, a fortune was being spent on software maintenance. Of course, this was a licence to print money for many defence contractors. Falling back on the true and tried methods of standardisation, the US Air Force created the PDP-11-like Mil-Std-1750A 16-bit machine instruction set for embedded computers, and the US Navy standardised on its CDC UYK-14 architecture for ships and aircraft.

Almost all US embedded systems since the late seventies have been built with these machine architectures, with the exception of specialised signal and data processors, built around DSP chips like the TMS320 series, or exotica such as the i860 vector engine, or UK Transputers. Concurrently, the USAF also standardised on the Fortran / C like JOVIAL high-level language, so that across the board high level and assembly code was now standardised. In the UK, CORAL became the high level language of choice, while assembly code was still produced in proprietary instruction sets.

This standardisation effort was a major improvement in many respects over the earlier hodgepodge of adapted commercial equipment, but still left a split between US Air Force and US Navy equipment users, and the commercial computers used

NETWORK CENTRIC WARFARE:

One of the most important trends seen in modern warfare today is the networking of 'sensors, shooters and weapons'. Digital coordinates are transmitted over radio links permitting freshly located targets to be attacked and killed in a matter of minutes. The destruction of four armoured and mechanised divisions of Republican Guards in less than two weeks was done in this fashion, with digital links between reconnaissance and surveillance systems and bombers. The next step in this evolution is the networking of the bombs as well, to permit them to be retargeted in flight, or to follow moving targets. In the recent Affordable Moving Surface Target Engagement (AMSTE) trial demonstration in the US, a GPS-aided JDAM bomb was modified with a digital JTIDS datalink receiver, and used to attack a column of moving vehicles. Two aircraft used their radars to triangulate the target from well beyond visual range, and the continuously updated target coordinates were transmitted to the bomb during its two-minute flight to impact. This technique permits blind bombing through cloud, dust storms, smoke and fog, from ranges of tens of miles, using cheap $20,000 GPS-aided bombs rather than expensive $250,000 optically guided bombs, or even more expensive $1m standoff missiles. Without generous amounts of computing power in the radars, target data processing systems, digital networking equipment and the bomb itself, this technique would be impossible.



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EYES AND EARS IN THE SKY

Some of the least visible yet most important tools in the modern digital warfighting play are surveillance aircraft, which monitor the movement of opposing aircraft, helicopters, ground vehicles and missile systems, and the radio frequency emissions produced by radars, radios, mobile phones, and more recently microwave communications links and wireless LANs. The E-3C AWACS provides radar surveillance and electronic intelligence, the E-8C JSTARS monitors ground vehicles and helicopters, and the RC-135V Rivet Joint eavesdrops transmissions in all bands. All of these aircraft, based on modified transports, are crammed with microprocessor-based operator consoles. Latest upgrades have seen large LCD displays and commercial processors used, although frequently ruggedised or even consumer grade laptops are plugged in to provide quick fix additions. The new Multimission Command and Control Aircraft (MC2A) will replace the E-3, E-8 and RC-135, and is built wholly around commercial computing hardware.

The example E-8C imagery combines high-resolution radar images, Moving Target Indicator mode radar tracks of ground vehicles, and GIS mapping data – the demand for such capabilities even in fighter aircraft is driving the adoption of commercial computing hardware.

for inventory control and accounting.

Thus was born the ADA language, the favourite hate object of many in the Computer Science community. The idea behind ADA was to produce a high level language standard to encompass all military applications, from the high speed realtime embedded systems, down to the massive equivalents to commercial systems, used for logistics and specialised databases. ADA did not prove to be the panacea intended and required its own community of costly code cutters, as result of which much of the latest military software is being written in C and C++.

So today we still have a Tower of Babel in military computing, revolving about a mix of standard machine instruction sets, board layouts, busses, new and old military language standards, and flavour-of-the-month commercial standards.

Transformation: more than meets the eye

The big buzzword in the military game right now is 'transformation' – the idea is to rapidly evolve military systems to adapt to rapidly evolving enemies. The main thrust is 'digitisation' of military systems across the board. Whereas a 1980s guided smart bomb will have used an analog interface, or perhaps even a mechanical lanyard to initialise the guidance system, a contemporary smart bomb will be digital and talk to the launching aircraft via a digital interface. The intent is ultimately to have all aircraft, ships and ground vehicles networking with digital radio datalinks, and tether all weapons via digital radio datalinks. The whole chain will be digital, from the sensor which spots a target, such as a radar or a thermal imaging array chip, to the bomb which blows it to bits.

Transformation is producing enormous pressure to cram increasing amounts of performance into military platforms and guided weapons, yet it's also producing a voracious appetite for digital communications bandwidth inside equipment and through digital radio datalinks.

The military is now faced with the serious issue that very frequently only the latest commercial hardware has the performance to do the required job.

The existing 16-bit military machine standards which have been pretty much mandatory in embedded systems are now three to four generations behind the current state-of-the-art in commercial machines.

In many instances this has proven to be irrelevant, because a flight control system or missile guidance package at most requires doubling, tripling or quadrupling of its performance over the life of the host system to accommodate growth in the code it hosts. The result has been the emergence of specialised manufacturers such as Performance Semiconductor (www.performance-semi.com) or CPU Technology (www.cputech.com), who produce MilSpec-rated -1750A chips, ROMed microcode and all, with improved clock speeds, year by year. These devices are built first and foremost for extreme reliability, and the internal architecture is generally stable. An interesting deviation from this trend has been the development effort by CPU Technology to produce a superscalar instruction set-compliant -1750A processor, with something close to ten times the performance of the currently standard 3-10 MIPS engines. So ships, aircraft and missiles designed in the sixties, and built during the sixties, seventies and eighties, and refitted in the meantime with -1750A-based systems, will live on with new build -1750A processors.

Standardisation in programming languages proved to be a failure and the current trend is to adopt 'industry standard' languages for which plenty of tools and programming talent exist in the market.

In terms of machine architectures, the biggest driver today is 'cost versus performance' – or simply raw performance. Many newer items of military equipment are hungry for computing power, as they involve graphics intensive displays and sophisticated signal and data processing. Only commercial chips, such as the Pentium 4, Athlon, PowerPC and UltraSPARC, have the performance needed, so we are seeing an ongoing drive to use Commercial-Off-The-Shelf (COTS) computing hardware – often rebuilt to MilSpec standards.

Internal system bandwidth requirements for equipment such as radars, electronic warfare equipment, optical equipment and weapons management systems have outstripped the capacity of the ubiquitous -1553B bus, no differently than has occurred with its commercial cousin, the 10BaseX Ethernet. We are observing an increasing use of fibre-channel standard interfaces in the latest military systems, and Ethernet, where timing performance is less than critical.

The future for military computing?

Several interesting trends are evident at this time.

The trend in high density embedded systems is a shift away from the 'federated system architecture' model of the 1970s, in which a central CPU controlled a package of variously intelligent black boxes in various parts of the system. The current trend, typified by the US Air Force's Lockheed-Martin/Boeing F/A-22A fighter and its Central Integrated Processor (CIP), is to go for a large, redundant, multiprocessing machine with a very fast, fault-tolerant backplane – a scheme termed 'Pave Pillar'. Instead of doing the computer-intensive chores in specialised black boxes, such as radar and electronic warfare signal and data processors, it's all concentrated in the redundant central computers. Like this, several processor boards can fail, and the load is simply shifted to other, working boards, in the main processor.

The mix of -1750A general purpose processors, specialised vector processors and digital signal processing chips – all on various board shapes and sizes, and using various busses — is replaced by a model where all processing is done by a battery of identical, general purpose superscalar RISC engines, in a standard form factor on a common high speed backplane. The black boxes are dumbed down to their analog components, and high speed digital to analog, and analog to digital converters, which interface to the central processors through high speed busses. The software maintenance effort is concentrated in the central processors, which perform all computing on the system, and adding or replacing identical central processor boards addresses performance upgrades.

While the first generation of Pave Pillar in early production F/A-22A fighters is now, for all practical purposes, obsolete — using liquid cooled VHSIC custom silicon dies for number crunching and i960 chips for internal housekeeping, the current intent is to replace the VHSIC/i960 combo with commercial standard processors to improve performance and cut costs. The second generation CIP will most likely be found in the F/A-22A fighter and its much less capable and smaller bomb trucking cousin, the F-35 Joint Strike Fighter – and most likely use either Intel or PowerPC processors.

This trend will dominate the design of new equipment. If the US Army's new Comanche scout helicopter is built, it too will use a Pave Pillar-derived system.

Equipment built around existing standards, and semi/non-standards, will remain in many instances in service for decades: the US is planning to keep its B-52H fleet – which was built in the early sixties – until 2040! To remain competitive, such systems will need to be incrementally upgraded through their remaining life.

One approach will be newer -1750A-based boards in existing semi-proprietary formats. The other is the rapidly proliferating MilSpec VME standard, essentially commercial/industrial embedded VMEbus hardware manufactured to MilSpec environmental standards. The US Air Force launched this effort under the 'Bold Stroke' program during the late 1990s, starting with the Boeing F-15E fighter and using the PowerPC chip beloved of Apple Mac users.

The current upgrade on the RAAF's 1960s-built F-111C includes a VMEbus PowerPC processor – A healthy improvement providing it with vastly more computing power than the RAAF's 1980s-built F/A-18A fighters.

A number of manufacturers now supply MilSpec-rated VME chassis designed to fit in aircraft, armoured vehicles and ships. Depending on the environmental harshness, fully MilSpec or industrial grade VME processor and I/O boards can be fitted. Processor architectures now available cover the Motorola/IBM PowerPC/RS-6000, Pentium, Alpha, SPARC and MIPS engines, as well as the trusty -1750A.

This will allow the use of almost current commercial Silicon, as well as much reducing development time and prototyping costs. Systems can be developed, and code cut, on commercial variants of boards, while the MilSpec variant is being certified 'everything-proof'.

A 10Mb/s optical fibre variant of the -1553B bus, the -1773 bus, has been adopted and will reduce some pressure insofar as box-to-box bandwidth goes. Optical 10BaseF and 100BaseF Ethernet has been adopted for some systems, such as command and control aircraft and naval weapon systems, and fibre-channel is now being used in a number of new fighter designs.

The clear trend in supporting established military systems would be to replace specialised hardware with MilSpec variants of commercial hardware, or ruggedised commercial hardware, wherever possible.

The differences between military computing and commercial computing are profound, and they are as much a reflection of different functional and support needs as a deeply differing history. With commercial chips like PowerPC and commercial languages like C/C++ replacing specialised military hardware and software in increasing numbers of systems, we are seeing military computing return to its 1960s roots in 'hardened' commercial hardware — military computing has travelled a full circle.

What is certain is that interesting times lie ahead for players in the military computing game.

HUDS

FIRST GENERATION 'GLASS' COCKPIT
F-111D 1969/70

SECOND GENERATION 'GLASS' COCKPIT
F/A-18E/F 1999

THIRD GENERATION 'GLASS' COCKPIT
F/A-22A 2003

FOURTH GENERATION 'GLASS' COCKPIT
JSF + F/B-22A 2010 (Mockup)

ATI RADEON 9800 PRO vs NVIDIA GeForce FX 5800 Ultra

NVIDIA owners are begging for ATI to get sin binned. It just can't keep its hands to itself – and who can blame it? Whammy one was the 9700, and Bennett Ring wonders if NVIDIA's GeForce FX 5800 Ultra can stand against the 9800 PRO sucker punch.

Overclock your 3GHz Pentium 4 to 17GHz, and you're guaranteed to rip the time space continuum a new one. You could be faced with instant spaghettification; however, we prefer 'situation happy'. Which means time travel. So, if you could blast back to November 2002, you'd find a very different video card scene to todays. You could also clean up on the stock market.

If you were to suggest to a 2002 gamer that ATI could make the fastest card on the planet, you would be laughed back to the future, with a thwack to the back of the head with a GeForce 4 Ti4600 to hurry you on your way. However, since the release of the inspiring RADEON 9700 PRO and the abominable GeForce FX, ATI has totally changed the notion that its cards are only suitable for those living in caravan parks. It proves how fickle PC gamers can be – within the space of four months, ATI has gone from a joke to the most respected manufacturer of video cards. The RADEON 9700 PRO has proved many times over that it canes NVIDIA's fastest, yet ATI hasn't been resting on its laurels. Instead it has continued to refine the RADEON 9700 PRO, and the result is the RADEON 9800 PRO. How much extra performance has ATI managed to squeeze out of a chipset that many thought was already running at close to its maximum potential speed? Let's bench.

Wheel reinvention?

The might of the 9700 PRO is the R300 chip. Thanks to this super piece of Silicon, the 9700 eats frames and spits out polygons with no trouble. The 9800 PRO uses the R350, which is a slightly refined version of the same mega-chip. The biggest difference is that the R350 runs slightly faster at 380MHz, a 17% increase over the R300's frequency of 325MHz. ATI managed to squeeze extra speed out of the R350 by identifying areas within the R300 that could undergo improved timing and signal integrity tweaks. This increase in clock speed has given the R350 a mind boggling maximum theoretical pixel fillrate of 3-gigapixels/second.

The other major difference between cards is the frequency of the DDR memory, which has been bumped to 340MHz, 10%

faster than the 9700 PRO's 310MHz. This memory is still using the uber-powerful 256-bit memory bus, but because of the increase in speed the total memory bandwidth has increased to 22GB per second. A 256MB version of the RADEON 9800 PRO should be out by the time you read this. We made do with a 128MB on our test card, which was kindly supplied to us by ATI (www.ati.com).

Based on these frequency increases, you'd only expect a maximum performance increase of 17%, yet our benchmark results suggest other tricks are going on behind the scenes that enhance the performance. Delving into ATI's tech docs for the 9800 PRO reveal that ATI has indeed made a couple of further tweaks to the R350.

Get smart

The first of these is SmartShader 2.1, which refers to the card's DirectX 9 pixel and vertex shader 2.0 capabilities. The difference between the 2.1 and previous 2.0 version of SmartShader is the implementation of an F-buffer. This idea was first proposed by William Mark and Kekoa Proudfoot at Stanford University in their catchy paper titled *The F-Buffer: A Rasterization-Order FIFO Buffer for Multi-Pass Rendering* (http://graphics.stanford.edu/projects/shading/pubs/hwws2001-fbuffer). Easy Sunday afternoon reading. . . not. F-buffer stands for Fragment Stream FIFO buffer, and increases the efficiency of the R350 when it comes to handling multi-pass operations per pixel. Here's how it works.

Graphics chips that use shaders have a limited number of resources for each rendering pass. In the case of the R300's pixel shader, 96 instructions were the maximum possible for each pass per pixel. But certain spiffy visual effects need more instructions than this applied to the pixel, resulting in a multi-pass operation.

Unfortunately this means that for each pass, redundant information about all of the pixels is passed through the entire rendering pipeline multiple times until the necessary number of shader operations have been completed, just to get the pretty effect on only a few of these pixels.

The introduction of an F-buffer helps stop this multi-pass problem. It passes only the pixels that require a multi-pass through the rendering pipeline multiple times, while those that don't need to be multi-passed are passed only once. By doing so rendering time is reduced, alongside memory bandwidth requirements. But increased performance isn't the only benefit of the F-buffer.

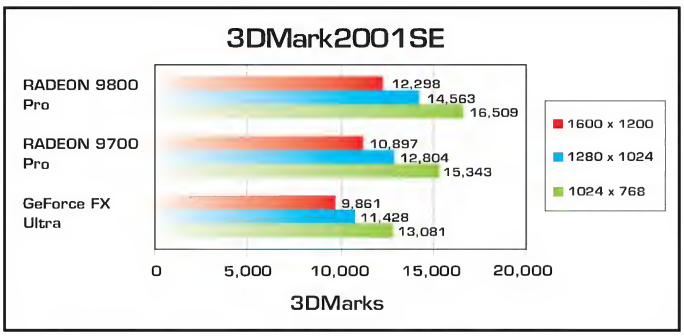
Currently programmers need to write special multi-pass code when a multi-pass operation is going to occur. However, ATI's implementation of the F-buffer means that this no longer need happen – all multi-pass code will be completely transparent to the programmer.

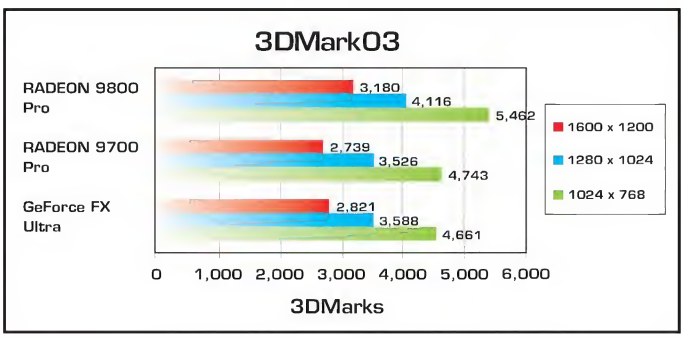
Butt smooth

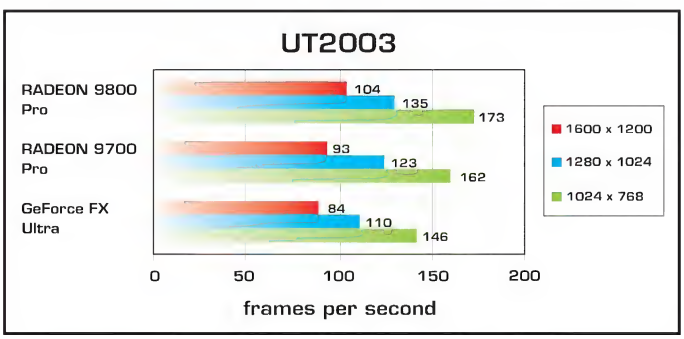
We already know how brilliant ATI's implementation of antialiasing was in the RADEON 9700 PRO, especially when compared to NVIDIA's solution, but ATI obviously felt there was yet again room for improvement. Enter SmoothVision 2.1. This enhanced version of SmoothVision uses antialiasing-specific memory controller optimisations to improve read/write requests. These enhancements aren't really noticeable until bandwidth demands are high – you'd need to be at 1,024 x 768 with 4x or higher antialiasing to really notice a difference.

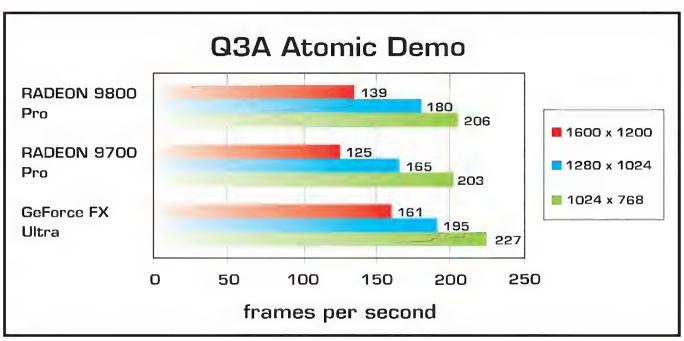
Up your Z-buffer

One of the leading consumers of a video card's memory bandwidth is data to and from the Z-buffer. In layman's terms, this information determines how close or far away something is to the rendering viewpoint. The R350 uses HYPER ZIII+, an enhancement of ATI's HYPER ZIII technique, with a heavy focus on improving performance when calculating stencil shadow volumes. There aren't many titles at present that use these shadows, for the simple fact that they are resource intensive, but it will be interesting to see what sort of a difference it makes when Doom III is out.





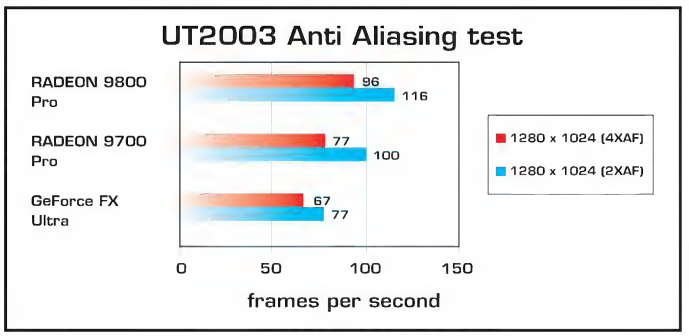


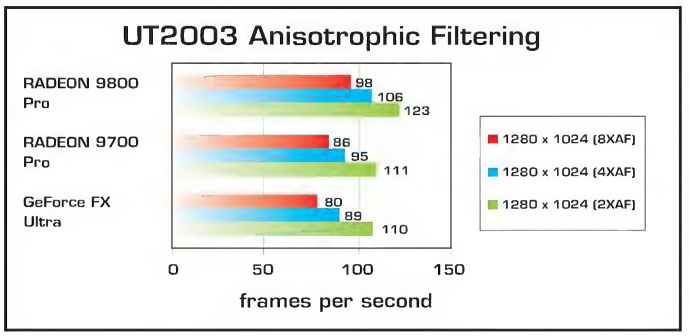


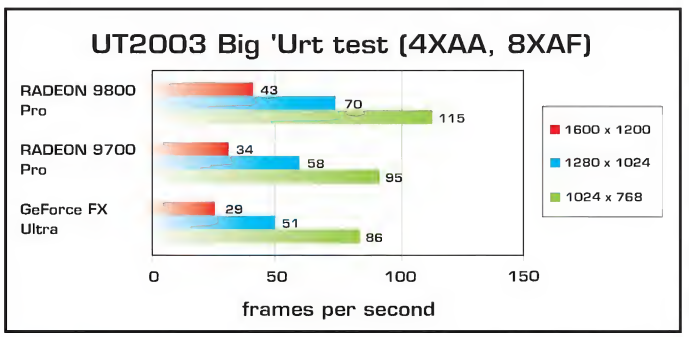
Excite down

While all of these techniques sound cool, in reality they don't make the R350 radically different to the R300. These are minor tweaks to the R300, not a whole new architecture, so don't expect a massive performance increase over the RADEON 9700 PRO.

However, ATI has done just enough to make this card worth checking out, as we discovered when we dragged the 9800 PRO into our Labs for a workout.







Time for the test

To reduce bottlenecks, we used a 3.06GHz Pentium 4 (Hyper-Threading disabled) with an i845PE mobo and two sticks of 256MB Corsair DDR-RAM running at 333MHz. Windows XP Professional was our operating system, with DirectX 9.0a and the latest official drivers for all video cards. In the case of ATI these were the Catalyst 3.2 drivers, while the MSI GeForce FX 5800 Ultra was powered by the 43.45 Detonators. Graphics settings were set to maximum quality and vsync was disabled.

Test number one was everybody's favourite synthetic benchmark, 3DMark2001SE Pro. As expected, the 9800 PRO totally dominated at every resolution. It had an average performance lead of approximately 26% over the 5800 Ultra, while it owned the 9700 PRO by an average of 12%.

NVIDIA hates 3DMark03, so we ran it to see how much more of a thrashing NVIDIA was going to take. Surprisingly, it turns out that the 9800 PRO doesn't have as much of a lead over the GeForce FX Ultra as it does in the 3DMark2001SE Pro test. This time the 9800 PRO had an average lead over the GeForce FX of 15%, and 16% over its predecessor.

Quake 3 Arena is getting old these days, but it's an engine that's still in use. Lucky for NVIDIA, this was the only benchmark that returned a result in its favour. NVIDIA have traditionally had strong OpenGL support, as seen by its average 12% performance lead over the 9800 PRO. OpenGL seems to be losing developer support however.

The final gaming test was our new favourite, Unreal Tournament 2003. We used [H]ard OCP's UT2003 v2 benchmark, and the final frame rate was an average of all the frame rates from every map. Once again the 9800 PRO kicked serious NVIDIA booty, coming in at an average of 22% faster than the GeForce FX 5800 Ultra. As seen in all of the tests with no antialiasing or anisotropic filtering, the 9700 PRO wasn't too far behind, with the 9800 only having an average lead of 9%.

Where the 9800 PRO really starts flexing its graphics muscle is in the image quality tests with anisotropic filtering and antialiasing enabled. We used UT2003 as the basis for these tests, with the highest quality anisotropic setting used for all cards. However, NVIDIA's performance setting for anisotropic filtering looks fairly woeful compared to ATI's implementation.

When testing with antialiasing, the 9800 PRO had an average performance lead of around 22% over the 9700 PRO, showing that the architecture refinements have led to a noticeable performance rise above and beyond the frequency increases. NVIDIA will surely cry into its pillow after seeing the 9800 had an average performance lead of around 46% over the GeForce FX Ultra.

Anisotropic performance was also improved over the 9700 PRO, but not by quite as much, with a lead of around 12%. NVIDIA lost the race this time by an average of 18%.

Out of the seven tests that were run, the 9800 PRO was the clear leader in six, and the OpenGL test is arguably less relevant due to the reasons explained. While it trounced the GeForce FX in most tests, the 9700 PRO managed to keep fairly close to the 9800 PRO, at least until anisotropic filtering and antialiasing were enabled.

Let the overclocking commence

The Samsung 301 K4D26323RA-GC2A DDR-RAM in use on the ATI RADEON 9800 PRO has a rated maximum speed of 350MHz (effectively 700MHz), so it wasn't surprising that we only managed to reach a memory speed of 360MHz. This isn't a huge leap above the default speed of 340MHz. The core faired much better, rising to an impressive 435MHz, an increase of 14% – not bad for an already speedy GPU. At these overclocked speeds the card was 100% stable without a single visual artifact in sight. We re-ran the 3DMark03 test at 1,024 x 768, and scored 5,932, a 9% overall performance increase.

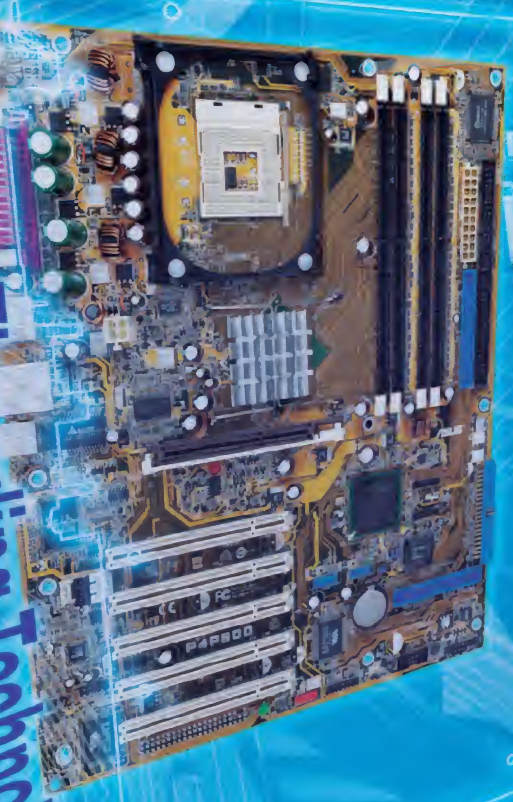
Hercules was also kind enough to let us give its RADEON 9800 PRO a thorough whuppin'. Priced at $999, this card is approximately $150 more than most 9800 PRO cards, but the inclusion of a full version of Rainbow Six 3: Raven Shield lessens the blow. As well as Raven Shield, for the extra dosh you get snazzy yet useless copper RAMsinks, and a copper GPU cooler with a blue LED mounted within. It doesn't appear that these really do much though, as the overclocking performance of this card is very close to the ATI RADEON 9800 PRO. The core began begging for mercy at 440MHz, while the memory peaked out at a slightly faster 375MHz – the 3DMark03 score (at 1,024 x 768) was very close to that of the ATI card, at 6,067.

What a card

The RADEON 9800 PRO is easily the finest video card available for gaming. In fact, its only competition is the RADEON 9700 PRO. You can expect 9800 PRO cards to retail around the $800 mark, proving once again that ATI can deliver the ultimate in performance at a price point well below $1,000.

We wouldn't recommend upgrading if you already have a 9700 PRO – it's just not worth paying another $800 for an incremental performance increase. However, if you're using any other video card, the RADEON 9800 PRO will make a marked difference to your gaming performance. We have to take our hats off to ATI, who has once again provided us with a card that can capably handle any of today's games with all the eye candy cranked to the max.

Hyper-Threading Technology



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Missing in action: Whereabouts now known

Once high tech, now low profile. James Wang hits the road to track down the companies we all loved but have since dropped off the radar.

3dfx Interactive

3dfx brought 3D to the PC. With insanely successful cards (Voodoo 1 and 2), a proprietary API (Glide) and the support of the entire industry, this company could have monopolised the market for years to come. In reality, it was lead by a CEO with a record of rehashing old products, the company itself failed to capitalise on its advantage, and made mistake after mistake, both managerial and technical. The internal mismanagement translated to future products (Voodoo 4 and 5) whose designs were both technically misdirected and hopelessly late. In fact, nearly every 3dfx product was late in one form or another.

The original Voodoo missed internal milestones and only launched thanks to a sudden drop in memory prices. The Voodoo Banshee was nine months late, the Voodoo 5 almost a year and the mythical 'Rampage' chip completed only after a total redesign and nearly four years of R&D resources. In the dieing days of December 2000, what would seem to the outsider like a fairy tale story ended with the selling of assets to NVIDIA. Soon after, the company's doors were closed and the company dissolved. More than a hundred engineers, including Chief Scientist Gary Tarolli joined NVIDIA where they met with old friends (Brian Burke, ex-3dfx PR manager), many of whom jumped ship long before the bitter black Friday finale. The co-founder and Chief Technical Officer, Scott D. Sellers, to this day remains somewhat embittered over the loss of the company maintaining a low public profile.

Verdict: Horrific management; feature creep causing no execution; poor OEM business.

Contribution: Bringing true 3D acceleration to the PC.

Bitboys

Bitboys is a cursed company. Started in 1991 by ex-Future Crew members who were tired of the lack of graphical power on the PC, the company set out to design its own chips. Its first chip, the Pyramid3D, was developed in collaboration with fab partner Tritech. When the chip finally made it to silicon, Tritech lost a major law suit on an audio patent infringement case. With auditors banging on doors for royalties, Tritech went bust and along with it, Bitboys' first graphics processor. The Pyramid3D, by 1997 standards, (Voodoo 1) is almost a fantasy. It featured programmable pixel shaders that would be the rough equivalent of our DirectX 8 standard today, as well as a geometry engine – a term unheard of until the Geforce256. This engine featured a fully programmable pipeline that supported loops and subroutines. The degree of flexibility in certain areas comes close to today's latest R300 and NV30 GPUs.

With no partner to produce their chip, Bitboys continued

designing its next processor, which places heavy emphasis on bandwidth through the use of eDRAM. Long story cut short: after several revisions and troubles with its new partner Infineon, the 'Avalanche3D' GPU reached working condition.

As if fate was against them, in the same quarter, Infineon posted a huge loss and decided to shut down its eDRAM-based production facilities. Bitboys once again was stranded with a finished product and no fab partner. Faced with financial difficulties, its Dallas office in the U.S. was shut and it looked to greener pastures. In just a few weeks, its engineers whipped up a vector-based processor for PDAs and cell phones. Finally last year, Bitboys signed a deal for its first successful chip. It's unknown who the buyer is but most likely a Japanese mobile phone company. A new office was setup in Noormarkku after this success and Bitboys earned a cool EU$150,000 profit for the last quarter of 2002. Good on them!

Case: Great dreamers; feature creep; bad luck, but persistence.
Contribution: Environment Mapped Bump Mapping (EMBM)

PowerVR

A new architecture is always refreshing, and PowerVR is the only company to have brought an alternative to immediate-mode rendering for PC graphics. An old player in the market, PowerVR competed along the sides of 3dfx, Rendition and Matrox in the early days of 3D. Its success peaked with the introduction of the KRYO II, based on the PVR Series3 design. This unexpected chip took market share in the retail channels thanks to a partnership with Hercules. Unfortunately the follow-up product never arrived. STMicroelectronics, the board maker for KYRO-based products, decided to sell off its graphics division last February. In light of this loss, work on the Series4-based products was cancelled and Series5 development gained momentum. This time with DirectX 9 taking precedence, tile-based hidden surface removal will offer a different kind of advantage. As long shader instructions can take many cycles to complete, an early kill method like TBR can save enormous processing time. Series5, due in 2003, will be based on a 0.13-micron process and is expected to have some degree of DirectX 9 compliance. PowerVR has yet to decide whether they will produce the chip with a new partner or employ foundries such as TSMC.

Case: Was uncommitted to high-end 3D graphics; loss of fab its partner.
Contribution: Proving an alternate rendering method exists for 3D graphics.

Matrox

Parhelia was the last straw for Matrox and it didn't come close to saving the company. Even their 2D quality reputation has been scarred due to buggy silicon that produced rare banding problems. Unfortunately, Parhelia is likely to be the last GPU we see from Matrox for quite some time. There are many people reporting that Matrox has sacked its entire Florida graphics division – the core engineers behind Parhelia.

The design of this chip fell victim to the same feature creep, mismanagement and lack of tools that plagued 3dfx. Insiders claim that the lack of tools was the main reason for the delay. ATI and NVIDIA can afford complex simulators like the IKOS, which emulates an entire GPU via its Field Programmable Gate Array (FPGA). Every tier one graphics company use these to speed up chip design through early simulation. While Matrox engineers were faced with the daunting task of creating an 80 million transistor GPU, upper management refused request after request for the purchase of advanced simulation tools. This, together with the relatively inexperienced design team (the veterans were gobbled up by NVIDIA after the G800 disaster), produced the Parhelia as we know it, seven months late. All indications point to Matrox restructuring and will no longer further the development of high-end desktop GPUs.

Case: Poor management causing brain drain; mediocre tools and misplaced products.
Contribution: Evangelising multi-display solutions; hardware displacement mapping and fragment antialiasing.

THE STATE OF CPU MAKERS:

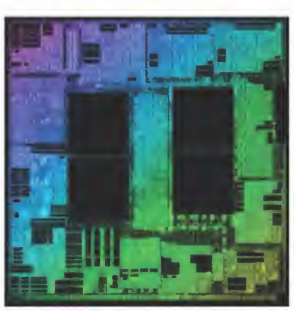
Unfortunately, VIA is still making its Cyrix-based C3 processors. Fortunately, they are no longer targeting desktop PCs. Its newest iteration uses the Nehemiah core, features a 'Padlock Data Encryption Engine' and will be used in mobile platforms. Transmeta, maker of the Crusoe CPU which emulates x86 in hardware is still alive after consecutive losses. It is doing better, and the company is expecting a profit by the end of 2003. With Linux founder Linus Torvalds working for it, everyone is cheering for the underdog.

Aureal

There is no sight more painful in the PC industry than to see revolutionary technology go to waste. Perhaps this rings true more so for Aureal than any other company.

The sound capabilities in the A3D 2.0 API were fundamentally different to anything the competition offered. By using 'wavetracing' Aureal did all 3D calculations based on the surrounding geometry in realtime. This is the way sound works in real life; reflecting off walls, bouncing through corridors and leaking through materials. Aureal's processors calculated all these factors as you walked through a level in Half-Life, basing the sounds on the geometry of your surroundings. This technology was unique to Aureal. Having served NASA and the US Air Force with similar technologies, Aureal refined this method and introduced it to consumer PCI cards.

Creative was not pleased. Their EAX line of cards could only deliver 'preset reverbs', which compared to A3D's ability, is like pre-rendered graphics to real 3D. Their own products were dragged from the ISA age and implemented into PCI. Creative also acquired Em-u Systems, and Cambridge Soundworks, and began a mass marketing campaign. Concurrently, volleys of lawsuits were exchanged between Aureal and Creative, mirroring the events between 3dfx and NVIDIA. Not surprisingly, Creative's deeper pockets and aggressive campaign won. The weight of the lawsuits, mismanagement (drivers, going solo like 3dfx) and poor marketing eventually sent Aureal



RANDOM FACTS:

1) Brian Skelton, ex-3dfx became CEO of Power3D, and now is now CEO of ATI board maker Sapphire.
2) At 3dfx, the standard attire was shorts. If you wore jeans, people thought you were in for an interview.
3) Ever wondered where Bitboys got its money from over the years?
It received royalties from Microsoft for its EMBM technology in DirectX.
It also received around eight million in private equity funding between 1999 and 2000.
Due the nature of the contract between Infineon and Bitboys, Bitboys likely received compensation from Infineon for exiting the production contract.
4) George Broussard owns a Ferrari, a 911 Strosek Porsche, an NSX and a Lexus LS400.
4) Some people have had Duke Nukem Forever 'pray'-ordered since 1997 from online stores like Chips & Bits. The product description still highlights: 'FULL 3dfx support!'

down the nasty Chapter 11 line.

Unlike NVIDIA, who continued to innovate and build on its own and 3dfx's technologies after the acquisition, EAX never gained the wavetracing ability.

Three years later, Creative' latest and greatest Audigy 2 still features environments based on pre-arranged reverb effects, not moving any closer to realtime, geometry-based 3D sound.

It is one thing to see technologies become lost then implemented, it is another to see it bought then sat on.

Case: Poor management; lack of marketing; various driver issues.

Contribution: Bringing realtime 3D sound through wavetracing.

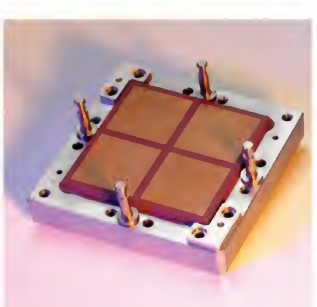
Multi-chip architecture

3dfx may be dead but the concept of scalable processors is alive and well. In fact, what 3dfx did with its Voodoo line will seem like a footnote when the technology is full realised. Who could have such profound influence?

Inside the Playstation2 is the world's most popular parallel computing machine – four chips work in tandem to bring graphics to the TV screen. This of course doesn't sound too impressive in the age of Xboxes and the GeForce FX, so Sony put sixteen of these together and produced what they called a 'GScube'. The GScube is a box the size of a microwave oven, that has sixteen PS2 mainboards crammed into it. Presented three years ago at Siggraph, it ran selected Final Fantasy scenes in realtime almost a year before NVIDIA made a similar claim with their Geforce3-based Quadros. Sony also announced plans to make a 64 board model and eventually follow up with a box with 100 times the power of the PS2 by 2003.

Since then – nothing. No announcements, press releases or leaks – what happened to the GScube? According to a certain PS2 developer, all internal development has stopped. Sony is now working on something along the lines of 'Renderman in silicon,' a massively parallel and scalable chip that simulates the Renderman API.

Last year, Sony joined forces with IBM and Toshiba to produce its next generation chip for the Playstation3. Dubbed 'Cell', this chip will start where GScube left off. Cell isn't your 3dfx/ATI two-chip, or even four-chip solution. Cell is scalable at *every* level: across die, board, and machine.



For example, the bases of the Cell architecture are 'processing elements,' or PE for short. These PEs are actually miniature 'systems on chip' (SoC), armed with their own high-speed embedded DRAM and dynamic memory access controllers (DMAC). One processing element can fit 16MB of eDRAM, an onboard DMAC, eight attached processing units (each armed with four floating and integer units) with work distributed by the on-die control unit.

Without getting into the details, it's easy to see that just one processing 'element' is armed with a huge amount of power and with eDRAM, it has the internal bandwidth to use it. But this is merely the beginning. Using sub 0.09-micron processes, four PEs can be joined on a single silicon wafer to produce a four-way Cell chip – think of it as four CPU dies on a single chip, each with its own high speed onboard memory!

At the introduction of the PS2, many, including Sony itself, called the machine 'crazy.' Surely enough, it drove many developers crazy with its impossible to partition parallel processors. If that is the case, then Sony better ship their PS3 development kits with cyanide pills for those who can't hand-write code to partition across 32+ parallel processing units.

AMD, Intel and Sony are all experimenting with scalable systems. ATI just built a four chip, R300 monster. Multi-chip architectures aren't fading, they are about to hit both PC and console space in a very big way.

Duke Nukem whenever

When games go past the four-year development stage – it's make or break. Mechwarrior 2 took four, Falcon 4.0 took almost five years and both ended as hallmarks in their genre. Then you have Daikatana and Battlecruiser 3000A.D, which despite taking an incredible amount of time (four and seven years respectively), ended up as train wrecks.

By now, Duke Nukem Forever is dragging to its sixth year, and there is still no hint on release other than the infamous line: 'When it's done.' Despite the delays of the game, DNF still managed to win awards, grabbing *Wired Magazine's* 'Vapourware #1' award for two years in a row.

So what went wrong? Why have many of us finished entire educations while a game is still under development? According to Project Leader George Broussard, many things: 'We're undeniably late and we know it. We've switched engines a couple of times, and we've started over a couple of times,' he told *Wired*.

When the game began the first phase of development in 97, there were only a handful of programmers on the job. For 3D Realms, despite scoring major hits such as Duke Nukem 3D, they did not have an army of programmers. With no more than 15 people working on a huge title, progress was slow. Adding to the delays were the engine switches, which caused much work to go to waste. Quake II's engine was ditched in favour of Unreal and Unreal upgraded to the UT.

The engine in its current state is said to be uncomparable to the original licenced UT engine but rather a complete custom build. When asked by his fans whether DNF, first started in the age of

bilinear filtering and 16-bit colour, could stand the heat against the new-age engines, he replied calmly: 'Don't worry about Duke's graphics. Trust me.' Low manpower and engine transitions aside, Duke Nukem Forever is late for more than a handful of reasons.

A major factor is the way in which 3D Realms operates as a developer. 'We don't have to worry about publishers telling us when to ship, what to ship, or dangling milestone checks over our heads,' a proud Broussard explained. The system sounds great, but in practice feature creep becomes the problem – the desired standard is always increasing while development can't close the gap. In the end the hype inflates to an expected standard that is impossible to reach.

Broussard is one of the last old school developers left. He's made himself a fortune with the original Duke Nukem series and a movie using the Duke license is set to go into production. Leveraging on this success, he has been able to work on DNF for so long without much publisher pressure: 'the game will be made on its schedule, not some suit's schedule.' Broussard is engrossed in making sure his Duke Nukem will once again break new ground.

If you were one of those who has followed the game's developments since '97, it's easy to see that Duke could have been rushed out the door two times and over had a more aggressive publisher been involved. 'Publishers have more to do with bad games in most cases than the actual developers. Most people are capable of great work, if given the time,' George reiterated. But is this attitude that's holding DNF back?

Given enough time, anything is possible, but feature creep comes back to bite. The seasoned Carmack (id Software) learned years ago: 'If you're doing something cutting edge, you're making fundamental decisions about your architecture, and if you let it slide for a year or two, then it's just not the right decision anymore. Even if you pile on all these extras, it's not optimal,' he explained during a 1997 interview on Prey. Not surprisingly, Prey – also under 3D Realms' direction, never made it to market. The moral is ringing truer than ever in the case of Duke Nukem Forever.

Hype kills. If 3D Realms has learned anything, then it's this. Since its 2001 E3 trailer for DNF, 3D Realms has dived below the radar and gone into a media black out. To the outsider, this somewhat common practice would indicate nothing more than driving away journalists and fans in order to refocus on work. The true intention is two fold: minimise hype and prevent the theft of game ideas. How could one steal ideas?

'We were able to deduce almost all of No One Lives Forever's gameplay elements from the screenshots they'd been releasing,' he said. 'Developers can and *do* see things in the screenshots other people release and they *do* take inspiration from them if they think they can use it and it will help their game,' a frustrated Charlie Wiederhold (level design) explained to unsettling fans.

Since Valve stopped releasing information on Team Fortress 2, other developers could no longer see their features from screenshots or otherwise – this has given the developer potential for originality. Screenshots also build up the natural expectation that every bit of the game will look as good, and in the end, people expect the game to feel a particular way – but hardly ever will the delivered product reach or surpass that level. 'Releasing screenshots every month/every couple of weeks is absolutely the worst thing we could do.'

Looking back, it's not hard to empathise Broussard's commitment to quality. But let us not forget Romero, Blackley and all those who had the same intention but failed to deliver. In recent times, Broussard and his team have made changes in the right direction. Whether these changes are radical enough and if it is willing to step over the brakes on feature creep will ultimately determine if our favourite hero will see the light of day once more. JW

THE STATE OF COMEBACK GPU MAKERS:

Trident came back a while ago with their XP4-series of GPUs. Big promises were made but little was delivered. The DX 8-classed cards that were meant to be a cheaper alternative to the GeForce4 ran out of steam in the FPS department. Soon it was declared by some online publications as 'dead on arrival.'

S3 has also been resurrected, making a similar claim with its 'DeltaChrome' DX 9 GPU.

It uses a hybrid tiling architecture and has been years in the making. Let's hope it has better luck re-entering the market than its code name 'Colombia' suggests.

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Hammering to bits

Hold the cavalry – Daniel Rutter has arrived. We've sent him in with a rusty screwdriver and a pair of shears, so hopefully he'll sort the Opterons we captured and have held at razor-point. Not trying the shave off any responsibility, but Dan's the cutter cowboy for the job.

Soon, you'll be able to buy the Athlon 64. A 64-bit Athlon.

PC CPUs have been 32-bit since the 80386. Now, mere PC users will be permitted to join the 64-bit cognoscenti.

If you just can't wait, then you can already buy the Opteron. It's AMD's fancier server/workstation chip using the same core as the Athlon 64. And we have a couple of Opterons to play with. So, should your next CPU be a 64-bit chip? What the heck *is* a 64-bit chip, anyway? And what can the Opteron teach us about the as-yet-unreleased Athlon 64? Read on.

Chip stuff

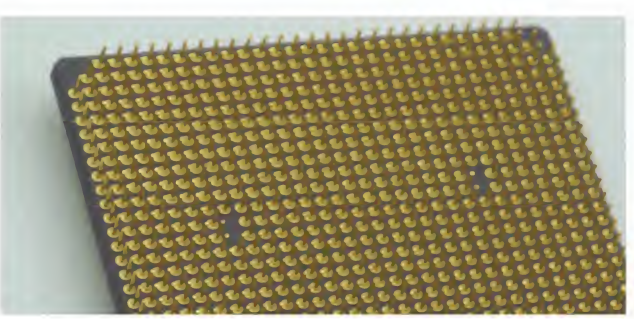
The Opteron's a funny-looking contraption. These initial models use a ceramic package, like the pre-XP Socket A Athlons; AMD may switch to the cooler-running organic packaging that current Athlons use for later models. At present, the 1.8GHz Opterons are only 50 to 60W CPUs, though, and the ceramic packaging works fine.

The chip is a mere 40mm square – not much for a modern server CPU – and the top of the package is almost completely covered by a hefty heat spreader. All those pins make clear, however, is that this isn't your daddy's ceramic-package CPU.

In fact, strapped to the underside are exactly 940 pins, which is more than twice as many as an Athlon XP.

The high pin count and small package size mean the bottom of the Opteron's almost completely covered.

The Athlon 64 won't look like the Opteron. It will have organic packaging, a standard hole-in-the-middle pin layout, and it will plug into the as yet unseen Socket 754. However, It'll still have that great big heat spreader to protect the core.



THE NAME GAME:

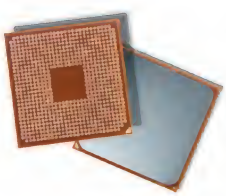
The original codename for the core inside the Opteron and Athlon 64 was 'Hammer'; the Opteron's the 'Sledgehammer' and the A-64's the 'Clawhammer'. They're both K8s, because they came after the Athlon, which is the K7, and they use the x86-64 ISA.

All of these names are being enthusiastically stomped on by the AMD marketing organisms responsible for branding. AMD's business partners have been firmly admonished to use the official names. The official name for x86-64 is 'AMD64'. If Intel ever makes an x86-64 processor, AMD would love to hear them call it '100% AMD64 compatible'.

The Opterons all have a three digit model number. The first digit is how many of that model of processor you can run in a multi-CPU machine, and the second two. . . have something to do with performance. It's, um, better if they're bigger. Yeah.

Seriously. That's what AMD has said.

Anyway, the first three Opterons to hit the market are the 240, 242 and 244, running at 1.4, 1.6 and 1.8GHz, respectively. They're all the same, otherwise; certified for two-way operation, with 1MB Level 2 cache. The pair we have for review are 242s.



Motherboarding

The dual Opteron motherboard we have to play with is an MSI K8D Master (MS-9131), using AMD's 8131 chipset – the only Opteron chipset in existence.

It's equipped with three PCI-X slots (with twice the bit width and twice the clock speed of regular PCI, which means four times the speed as well as backwards compatible with regular PCI), two regular PCI slots, and integrated ATI Rage XL video.

No, there's nowhere to plug your AGP card in. This is a server board.

There are also six somewhat oddly placed standard 184-pin DIMM sockets, for ordinary DDR-RAM. The board supports up to 12GB of registered ECC modules. Registered DDR is slightly slower and more expensive than plain non-ECC RAM, but allows bit error detection and correction. However, to reach the 12GB you'll *need* to buy 2GB memory modules, which will currently set you back an easy $US1000 each. Enjoy.

Behold – Socket 940. It's for the Opteron, and it has a whole lot of holes. There's no hole in the middle. But it works like any other Zero Insertion Force socket – you just lift the locking lever, drop the processor into place (it's keyed so it only fits one way), and then lock the lever down again. Easy.

The Opterons use a new and sensible CPU cooler design, too. Well, so we're told.

It's easy to see how the coolers install by looking at the back of the motherboard. This is a bolt-through cooler mounting system, like the four-bolt retention mechanisms used by some Socket A coolers, except with only two spring-loaded screws. They fasten through the motherboard into a standard back plate. There are no little hooks on the edges of the CPU sockets, and no plastic frames sitting up above the board.

The Opteron kit we recieved, though, didn't come with *any* CPU coolers. We had to just sit any old heat sink on top of the processors, and keep the board level so it didn't slide off. Snazzy solution, yes?

The K8D Master is built around two main chips. In the foreground of this picture, the chip under the oddly-aligned chunk of black aluminium (the production version has a better-looking heat sink) is an AMD-8131 HyperTransport PCI-X Tunnel and lets the processor talk to the expansion slots. It has a 16-bit HyperTransport link on one side that matches the HyperTransport links on the Opterons (and the single link on the Athlon 64) for speed, and an 8-bit HyperTransport link on the other side that's only half as fast, but is still more than good enough for everything else on the motherboard.

The other big chip, in the background, is what's hanging off the 8131's downstream HyperTransport link. It's an AMD-8111 HyperTransport I/O hub, and it handles almost everything else in the computer – including audio, USB, ATA drives, Ethernet, and regular PCI.

If you're toying with the idea of a nice little single processor Opteron machine for your very own, then NVIDIA's nForce3 Pro chipset, which should appear on ASUS boards 'real soon now', is probably what you want. The initial nForce3 Pro 150 has an AGP 8x controller, plus a 10/100BaseT Ethernet adapter and audio built in, but *no* integrated graphics adapter. Only parallel ATA plus a spare channel for a couple of optional SATA ports, but it'll do.

The upcoming nForce3 Pro 250 will have Gigabit Ethernet, and native serial ATA. The plain, non-Pro nForce3 will probably be NVIDIA's Athlon 64 chipset.

Bitness and you

Opteron is a new kind of animal. It's a 32-bit processor,

COMPATIBILITY:

For 64-bit software to work at all, you need to be running a 64-bit operating system.

Microsoft will be coming up with an x86-64 version of Windows some time this year. It's code-named 'Anvil'. Very funny. Betas should be out by about the time you read this.

Linux can support x86-64, naturally, and there are some ready-to-go distributions out already.

To blur the PC/workstation line a little bit more, Sun's working on an x86-64 version of Solaris, their proprietary Unix variant. And there are persistent hopeful rumours about Apple porting Mac OS X, or something.

Most people buying an Athlon 64 system in the near future, though, won't be running a 64-bit OS on it. Actually, it's possible that most people buying *Opteron* systems will stick with 32-bit for some time.

Install a 32-bit OS on your Opteron or Athlon 64 box and you'll be running it in 'legacy mode', where all of the 64-bit functionality sits there peacefully doing nothing at all, and your fancy new chip behaves pretty much like an Athlon with a tweaked core. No extra registers, no memory past 4GB. But you'll have full old-school compatibility, with real mode and virtual-8086 mode. If an old voodoo lady's cursed you with having to run Windows 3.11, it should run perfectly fine on an eight-way Opteron system.

If you're running a 64-bit OS, though, an Opteron or Athlon 64 machine will play *both* kinds of music. x86-64 code will run, and so will x86-32 code; the processor will run in 64-bit mode or 'compatibility mode' as necessary. 32-bit code still won't see the extra 64-bit registers or any RAM above 4GB, but 64-bit code will, and both kinds of code can be running at once.

32-bit code has to run in protected mode to work like this, but chances are that whatever you want to run *does* run in protected mode.

This is a big deal, because it gives people who're currently running 32-bit servers or workstations a painless upgrade path. Since x86-64 operating systems should seamlessly work with 32-bit software, nobody has to change all of their software when they change their hardware.

but it's *also* a 64-bit processor. Welcome to 'x86-64'.

The x86 ISA (Instruction Set Architecture) is what's used by all IBM compatible PC CPUs, including the current Pentiums and Athlons. It can trace its lineage back to the 16-bit 8086.

x86-64 is a surprisingly elegant extension of the x86 into 64-bitness. It gives you a processor that's perfectly compatible with current x86 software, but can work in 64-bit mode as well.

What's the difference? Glad you asked.

The 'bit width' of a processor is the number of bits its general purpose registers (GPRs) can hold, and the width of the internal data paths that supply these registers. The registers are the places where the processor puts data that it's processing; data has to be moved into one register or another before it can be worked on.

Wider registers let a processor work on larger numbers, if it has to, without slowing down. They also let it work on multiple smaller numbers at once; the x86-64 GPRs can be subdivided to accept 32, 16 and 8-bit integers simultaneously.

x86-64 processors running in 64-bit mode also have twice as *many* visible GPRs and Single Instruction Multiple Data (SIMD) registers, which adds up to much more effective data caching.

And then there's memory.

32-bit processors only have 32-bit memory addressing – they can only directly deal with two to the power of 32 bytes of RAM, which is four gigabytes. There's a dodge called Page Address Extension (PAE) that can pump that up, but it's neither neat nor cheap, and it will never be seen in consumer PCs.

Four gigabytes of RAM, for current home and office purposes, is a lot. Many motherboards can't even physically accept that much memory. But lots of big servers need a heck of a lot more RAM than that. And so, increasingly, do standalone machines.

If you're editing big image files with lots of layers or doing 3D CAD work, you can easily need more than 4GB of RAM. And then there are things like film-resolution video processing, the various and assorted applications generalised as 'scientific computation', and desktop publishing. All of these can make use of amazing amounts of RAM.

And then there's games. Get yourself a fast enough pipe between the graphics adaptor and main memory – AGP 8x need not apply – and you can use that main memory for storage of ludicrously detailed textures, vastly complicated geometry and so on. For truly photorealistic 3D, we're going to need memory out the wazoo.

To a CPU, a memory address is just another thing that passes through the registers. So 64-bit processors can handle 64-bit memory addressing.

Now, two to the power of 64 bytes of memory is a ridiculously large amount – 16 exabytes, or a bit more than 17 billion gigabytes. By the time we need that much memory we'll probably be installing it in starships, so the x86-64 designers sensibly restricted the memory to a 48-bit virtual address space – a mere 256 terabytes – and a piddly little 40-bit physical address space, which determines the amount of physical RAM you can install.

2^40 bytes is 1,024 gigabytes. One terabyte.

Performance

It's hard, at this stage to figure out exactly how fast the Athlon 64 will be because all we have to look at the moment are Opterons. We can make some informed guesses, though.

In ordinary business computing benchmarks, a single Opteron only performs like an Athlon XP running at around 1.1 to 1.25 times the core speed, which is unexciting. Who cares, though. Pretty much any old processor will do for basic business tasks.

For 3D games, the Opteron's faster memory access pushes it *much* further up the charts, and a single 1.8GHz Opteron can consistently edge out a 3GHz, 800MHz FSB P4 when the video card is removed from the equation.

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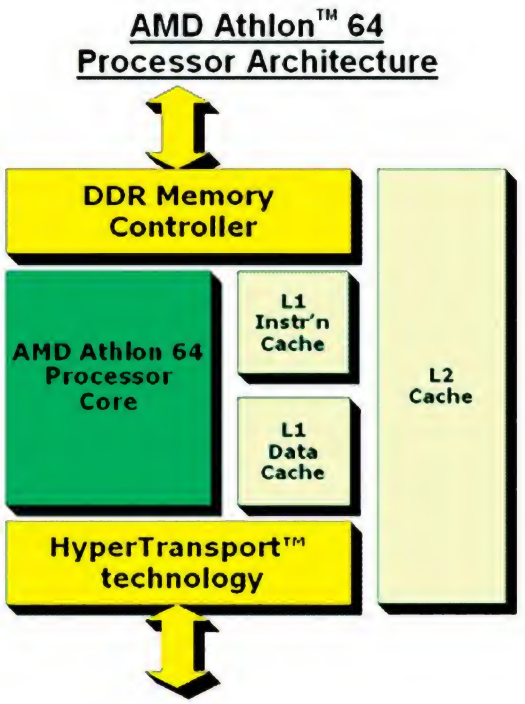
Here's AMD's visual explanation of the difference between the server-or-workstation Opteron and the normal-PC Athlon 64:



Well, that clears it up, doesn't it?

The arrows at the top represent the memory interface; 128 data bits wide for the Opteron, 64 for the Athlon 64. Both Hammer core processors have a DDR memory interface built in, which gives them full core speed access to memory, with pleasingly low latency.

Every other current PC CPU talks to a motherboard Northbridge chip of some kind, which in turn interfaces with the rest of the system, including the RAM. Thus can you have boards that take the same processor (a P4, for instance) but use different kinds of RAM (SDR-SDRAM, DDR-SDRAM or RDRAM). The Hammer-core chips, in contrast, can talk only to DDR memory. Different RAM will require a new AMD64 core or a motherboard with its own memory controller.

The integrated memory controller is a good thing for multi-Opteron machines, because each CPU has its own memory controller, good for up to eight DDR333 DIMMs. CPUs can access the memory of another CPU via HyperTransport. Monster Opteron servers with lots of processors should, therefore, also be able to have lots of RAM, and avoid bottlenecks.

The Opteron's 128-bit memory controller (plus another 16 bits, for ECC) can access two sets of memory modules in parallel, for double memory bandwidth. You have to install memory modules in pairs, and if you want to use more than two pairs you have to stick to DDR266 (PC2100) RAM, not DDR333 (PC2700), but this is still an excellent feature.

The new 800MHz FSB P4s use dual DDR400 memory, for superficially superior bandwidth. But they don't have a separate CPU bus for the memory.

The Athlon 64 doesn't have dual DDR, but Athlon 64 boards should at least support DDR400, which will help a bit. The lower Athlon 64 core speeds will *also* help here; higher core speeds make memory latency problems worse.

though – pro-3D rendering, for instance – the 3GHz P4 is likely to win by a reasonable margin.

In a nutshell, what everyone's tests so far seem to be saying is that Athlon 64s at a given clock speed will justify an 'XP rating' of about 1.5 times that clock speed.

A 1.8GHz Barton-core Athlon XP is an 'XP 2200+'; it's very easily the equal of a 2.2GHz P4, and can give a 2.8GHz a solid run for its money. A 1.8GHz Athlon 64 should justify around a '2700+' rating, on the same scale, and mix it very successfully with 3GHz P4s. And it'll run 64-bit software.

For workstation and server tasks, dual Opterons are strong competitors. Lots of people are using cheap dual Athlon boxes for these sorts of tasks, because they offer better value than dual Xeon solutions. Those people are likely to be quite interested in the roughly 50% better performance they're likely to see from a couple of current Opterons, let alone future models; taking the 64-bit OS and extra memory capacity into account as well, the decision's a no-brainer.

Opteron prices, at the time of writing, suffer from New Processor Syndrome; 242s and 244s are expensive enough to make Xeon systems noticeably better value for anyone who doesn't care about 64-bit. But mere Opteron 240s, at 1.6GHz, are about $US300 right now. That is about the same price as a 2.66GHz, 533MHz FSB Xeon, which will under perform the Opteron by a significant, but not a staggering, margin for mostly everything.

So what are they good for?

If you're reading this magazine, you probably don't care about 64-bit computing. Maybe you'll be running a 64-bit OS in the year 2008, but that may simply be because there'll be nothing else around that you *can* run. Most people running WinXP today, after all, have no use at all for many of its industrial-strength features.

Right now, the Athlon XP and the Pentium 4 are not about to be made obsolete by the Athlon 64. That's not surprising; new PC processors seldom have much of a performance advantage over the fully-tweaked and polished last of the old guard.

So if you're upgrading your PC this week, buy an Athlon or P4, with confidence.

If you want a serious 64-bit Linux workstation on your desktop, though, the Athlon 64 will be able to make it happen. An Opteron or two will do it faster. And you can install WinXP, too, and it all ought to 'just work'. Because it's basically an x86 machine, things like networking will work as you expect them to.

It's entirely plausible that there *will* be real home and small office applications – including games – for 64-bit x86 machines surprisingly soon. Even before the end of 2004. Just recompiling 32-bit software to run on an AMD64 OS can substantially speed it up, thanks to the extra registers made available.

The 386 is now old enough to vote. It's about time we moved on from 32-bit, but there's not a lot of point buying a system that'll only really shine with software that doesn't exist yet. So wait, and you'll save money.

WEB LINKS:

The biggest and best Opteron/AMD64 reviews and info, at time of writing:

www.anandtech.com/cpu/showdoc.html?i=1815
www.anandtech.com/cpu/showdoc.html?i=1818
www.aceshardware.com/read.jsp?id=55000251
www.tomshardware.com/cpu/20030422/index.html
http://arstechnica.com/cpu/03q1/x86-64/x86-64-1.html

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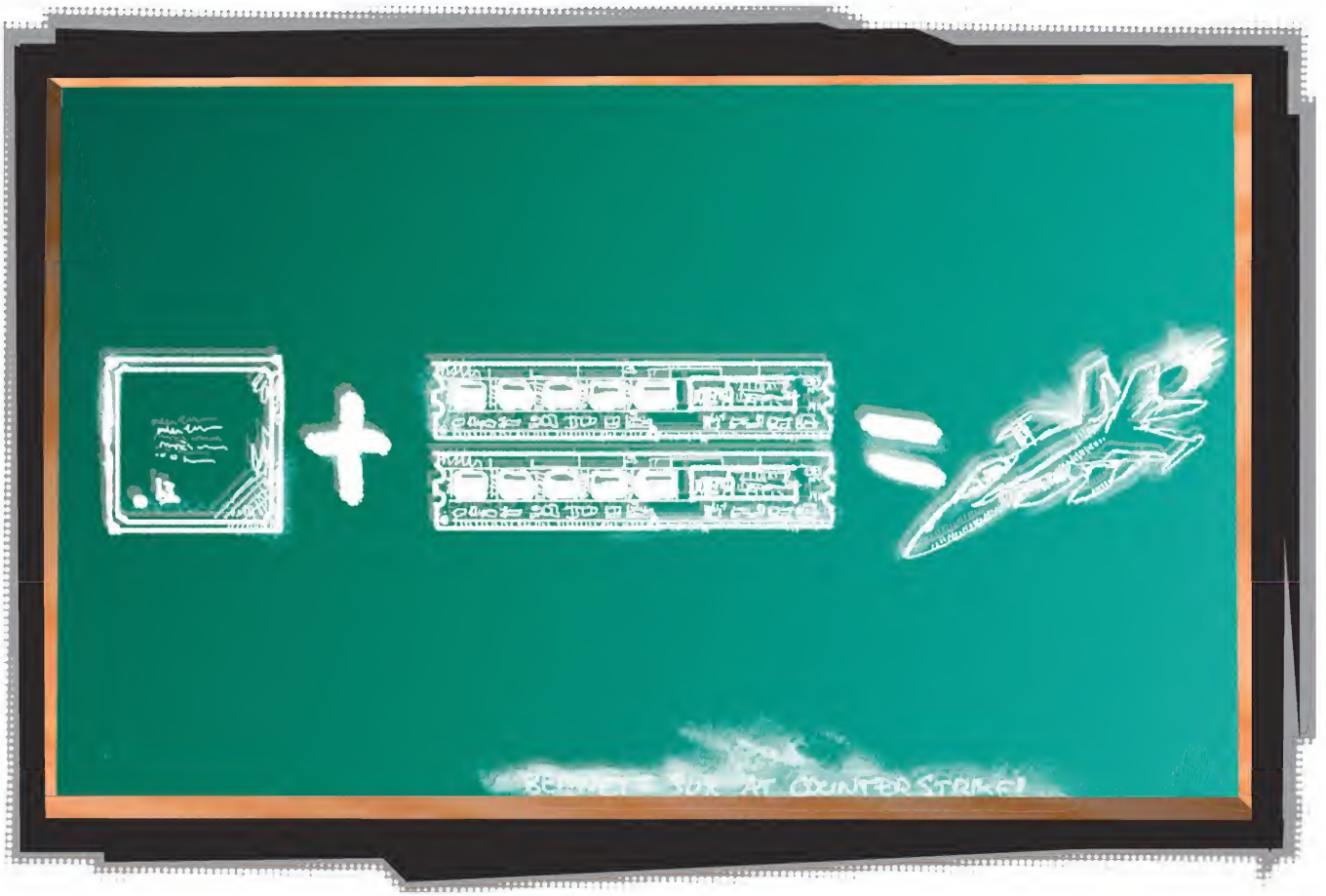


Crashing the Rambus

Intel hammers the final nail into RDRAM's coffin with its wholesale adoption of dual-channel DDR technology. John Gillooly is at the funeral.

Even though the CPU wars have calmed, largely due to AMD's constant delaying of the Athlon 64 desktop CPU, both processor makers have continued to provide minor boosts and tweaks to their product lines. While AMD is due to take the double-pumped Athlon XP bus to an effective 400MHz 'real soon now', Intel has already made its move, unleashing a revised Northwood core that runs at an effective 800MHz on its quad-pumped bus.

Both of these boosts seemed unlikely until very recently. Intel had quite publicly made it known last year that RDRAM was on its last legs and the huge consumer support for DDR-RAM was the catalyst. But the Pentium 4 is a bandwidth hungry beast, a by-product of Intel's original development push for a highly scaleable architecture. DDR would mean that the maximum bandwidth available for the CPU would be 2.7GB/s when using memory based upon the latest JEDEC DDR333 standard. This was not a huge problem for the Athlon XP as DDR333 provided ample bandwidth for the then standard 266MHz FSB and would easily cope with a planned upgrade to a 333MHz FSB.

Intel launched some very fast DDR chipsets, but even the top-end i845PE was unable to top the performance of the i850E chipset running PC1200 RDRAM. To combat this Intel focused on dual-channel DDR technology, something that had little more than novelty value in NVIDIA's nForce chipset for the Athlon. However the Pentium 4 would be better placed to leverage dual-channel DDR. It's then 533MHz FSB would be ideally matched with dual-channel DDR266, something that eventually emerged as part of Intel's workstation chipset, the e7205 (formerly codenamed Granite Bay).

With the e7205 DDR finally managing a convincing performance win over RDRAM, Intel ramped up its plans for the second piece of this particular performance booster – another increase in frontside bus speed. The initial plans were to up the FSB to 667MHz effective, matching it with dual-channel DDR333, but these were never to see the light of day, even with motherboards being launched that

ABOVE: **Two sticks of genuine, hard to find DDR400, which is needed to run the i875P with PAT enabled.**

touted pre-emptive 667MHz FSB support. Instead Intel did an unlikely thing and started pushing DDR400, a draft standard that had looked until that moment like it would never actually enter the market.

DDR400 meant that Intel could ramp the Pentium 4 FSB up to 800MHz, which would provide ample performance boosts until the next generation Prescott core could be launched. An 800MHz FSB Pentium 4 would need 6.4GB/s of memory bandwidth; DDR400 delivers 3.2GB/s in a single-channel configuration, and the magic 6.4GB/s in the dual-channel one. This dream was to become a reality with a new 3GHz Pentium 4 (not to be confused with the 533MHz FSB 3.06GHz model) and two chipsets, codenamed Springdale and Canterwood.

Canterwood, now known as i875P, is a refreshing and remarkable change for a company that once had a global policy of contacting every journalist who ever extolled the virtues of overclocking in order to educate them on the evils of the practice. It began life as a workstation chipset but has been released for the desktop with the enthusiast in mind.

Springdale on the other hand has become the i865 and given the responsibility of bringing dual-channel DDR to the Pentium 4 mainstream. The Intel 865 will be available in both a standard variant, the i865PE and an integrated graphics version, the i865G. The current i845 chipsets can support the 800MHz FSB but this will vary from motherboard to motherboard and it is advisable to check the manufacturer's Website for compatibility, and we would heartily suggest moving to an i865 or i875 based motherboard if you get an 800MHz FSB P4.

The Northbridges are physically identical, but in a move that we are very familiar with in the video card and CPU world, Intel has chosen and tested only the best quality dies for the i875P, and used this information to get better timings and other optimisations out of the chipset. This should not only make the i875P a little more expensive, it should ensure that the 875P will outperform the i865 across the board.

Each chipset supports the full range of 400, 500 and 800MHz FSB Pentium 4 CPUs, along with DDR266, 333 and 400 running in either single or dual-channel mode, but for optimum performance, especially with i875P, then the combination of an 800MHz FSB and DDR400 is the key. Besides being the fastest combination, this lets one of the major features of the i875P to come into play.

It's called Performance Acceleration Technology (PAT), and optimises chipset timings even further when running DDR400 and an 800MHz FSB CPU. The other differentiating feature of the i875P is that it supports ECC memory for entry-level workstation use.

DUAL-CHANNELLING:

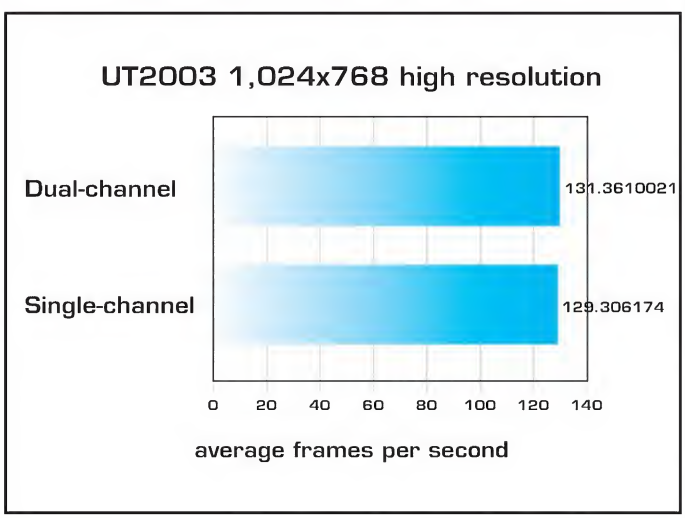
Dual-channel DDR is not a new concept; it was first implemented by NVIDIA in its Athlon-supporting nForce chipset. However the benefits of this were quite small, only noticeable in 3D benchmarks when using the integrated graphics capability. nForce2 also supports the technology, but it does not make a huge impact to the Athlon XP, whose 266 or 333MHz FSB is matched with that of DDR266 and 333.

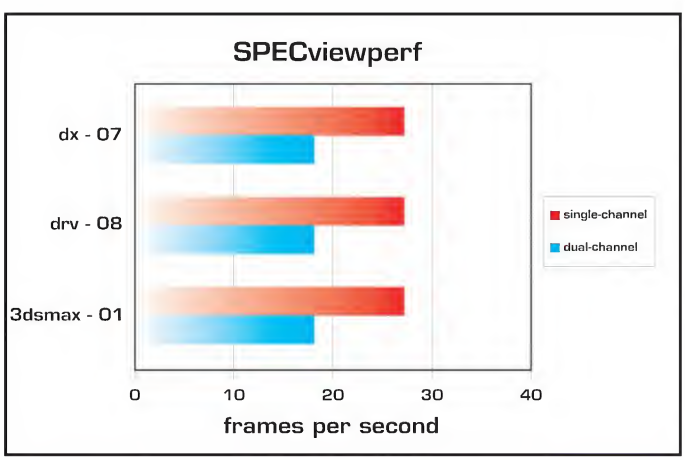
The Pentium 4 stands to benefit more because it needs dual-channel DDR to provide a bandwidth match between CPU and system memory. We have seen these benefits already with the e7205 chipset, and they continue with the i875P and i865. But the other, often ignored benefit of dual-channel DDR is that it provides extra bandwidth for other components that need direct memory access, predominantly the AGP controller and the IDE controllers. This can make for much smoother system performance and can be tested for by running benchmarks that stress the whole system.

We have tested the i875P in dual and single-channel memory configurations using SPECviewperf 7, which is a workstation graphics benchmark that stresses the CPU, AGP and I/O subsystem at the same time. We also tested with our standard Unreal Tournament 2003 graphics benchmark, at high quality 1,024x768. For the test we used DDR333 to avoid the extra effects that come into play when PAT is enabled.

UT2003 does not show much variance between single and dual-channel DDR. This is due to the fact that it predominantly stresses the CPU and GPU, and the need for extra bandwidth is minimal. However the much more balanced SPECviewperf benchmarks show a significant performance difference between the two memory configurations, with the performance boost in the range of 11-15% when using dual-channel DDR.

BELOW: **Dual-channel vs single-channel benchmarks. For a full explanation of the tests see the Dual-channeling boxout.**





ABOVE: **Intel's new flagship 800MHz FSB 3GHz Pentium 4.**

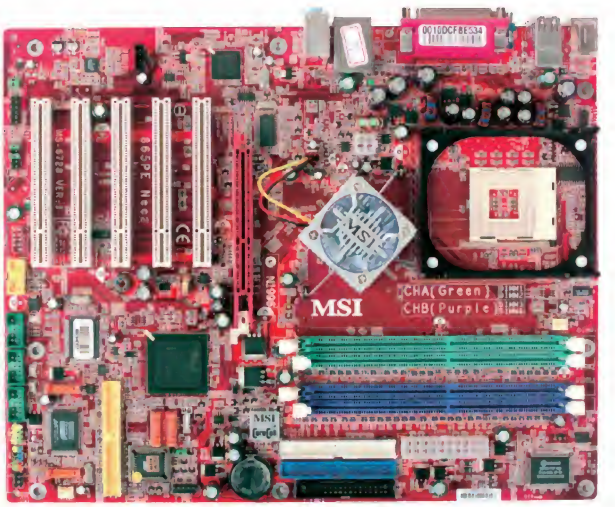
South central ICH

Intel is also using these new chipsets to introduce a raft of updates to its platform. Both Northbridges support the AGP 3.0 (AGP 8x) standard, something that Intel had only previously supported with the e7205. AGP 3.0 is low on the list of feature priorities anyway, as there is hardly any tangible performance difference between AGP 4x and AGP 8x. However, most of the new features are part of the new ICH5 Southbridge.

Available in two flavours, the ICH5 and ICH5-R, the Southbridge adds serial ATA support as well as a new technology called Communications Streaming Architecture (CSA). It still contains a parallel ATA controller, and like its predecessors supports the newer USB 2.0 standard. The ICH5-R also supports hardware RAID 0.

While Intel is the last major chipset manufacturer to market with AGP 3.0, it is the first with integrated support for serial ATA. We are huge fans of this technology here at *Atomic*, and anything that helps to kill the hellish nightmare that is parallel ATA is fine with us. Generally Intel's SATA implementation is a joy to use, but the BIOS interfaces for remapping SATA channels to the primary and secondary IDE slots we have seen in the Labs still need some work to make them understandable. The RAID implementation is an absolute joy to configure though, with an interface that even the most novice RAID'er will be able to cope with.

Much like the recent Centrino branding requiring a specific combination of Intel chips, Communications Streaming Architecture requires an onboard Intel 82547EI Gigabit Ethernet chip to operate. This chip can take advantage of the CSA port built into the ICH5, which bypasses the PCI bus, allowing for dedicated networking bandwidth. With this technology Intel states that you can squeeze almost 2GB/s out of standard Gigabit Ethernet hardware.



ABOVE: **MSI's 865PE Neo2 FIS2R motherboard, which has a huge feature-set that includes four SATA ports.**

Speed freaks

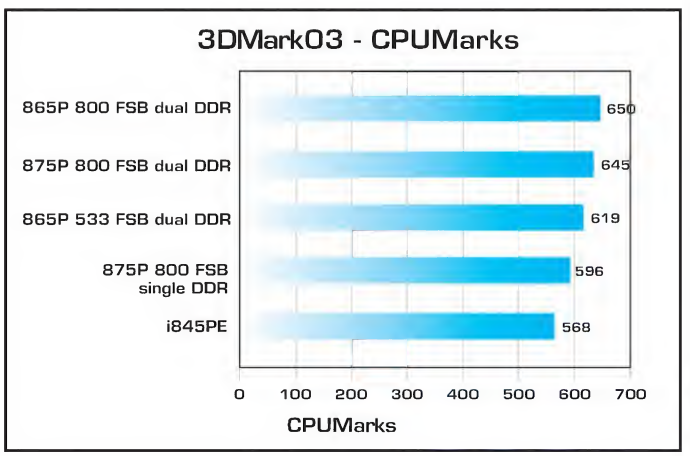
The i875P launch has been a chance for motherboard manufacturers to launch an assortment of feature packed motherboards, accompanied by more mainstream i856-based offerings.

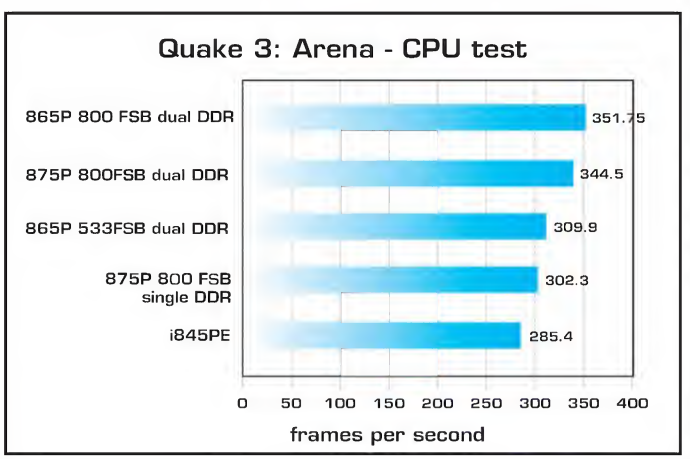
We have seen a few boards come through the Labs already, including Intel's long awaited 'Bonanza' board, the D875PBZ. This sleek black number has a surprising amount of BIOS tweaks for the enthusiast, but unsurprisingly lacks any actual overclocking tools.

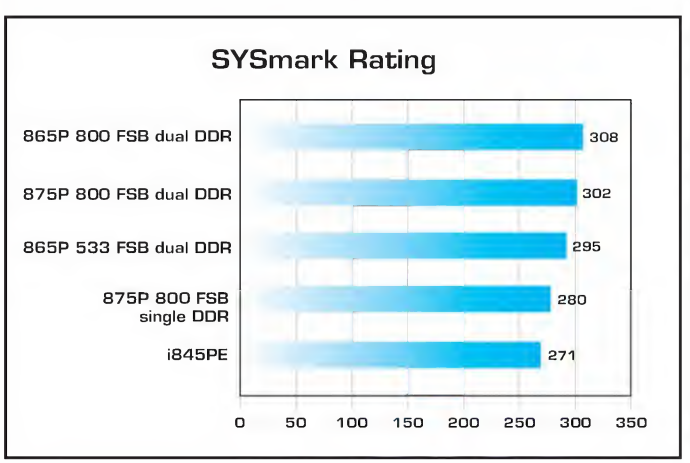
We have used the Gigabyte GA8KNXP-Ultra for our i875P tests and the MSI 865PE Neo2 FIS2R (say it out loud for a laugh) for our i865 ones. They were configured with a 120GB Seagate Barracuda 5 SATA drive, two 256MB sticks of KingMax PC3200 DDR and a GeForce4 Ti4800SE. For our FSB comparison tests we used an 800MHz FSB 3GHz P4 and a 533MHz FSB 3.06GHz P4. For comparison we have also included results from an i845PE board using a 3.06GHz Pentium 4.

Our first tests were with SYSmark2002, and they show a fairly predictable downwards trend in performance through the models. The i845PE is the slowest of all, followed by the 865P. The 875P is fastest of the pack, and scales with each performance enhancement, running fastest when in PAT mode thanks to the 800MHz FSB P4 and dual-channel DDR400.

In fact, there is about 5% more performance to be had







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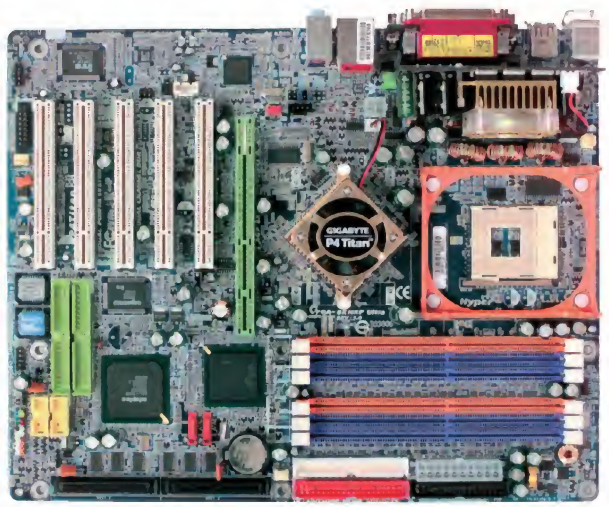
Soar to Success

by going for dual-channel with PAT over single-channel.

Despite its age, Quake 3: Arena is still a remarkable benchmark, scaling wonderfully with each generation of hardware. It is a bandwidth whore, which is perfect for CPU and chipset testing, but it doesn't stress the whole system like SYSmark2002 does.

This means that the results are slightly different from the SYSmark2002 ones. In Quake 3, the maximum bandwidth configuration of 800MHz FSB Pentium 4 and dual-channel DDR400 comes out well ahead of the others, with both chipsets posting fast scores. PAT gives the i875P a boost of a couple of percent. The reason for this is that the dual-channel DDR operation of the i865 and i875P supplies the optimum 6.4GB/s of memory bandwidth for the 800MHz FSB Pentium 4. In other situations the system is bandwidth limited, stuck at either the 4.2GB/s when using the 533MHz FSB Pentium 4 or at 3.2GB/s when using the slower single-channel DDR400. 3DMark03's CPU test is a much more up to date benchmark than Quake 3, but the same results are seen. The 800MHz FSB combo with dual DDR comes out the winner, both the i875P and i865 scoring almost identically, with the difference easily attributable to the normal background fuzz of benchmark results. Again the i845PE falls behind the rest of the pack.



ABOVE: **Gigabyte's GA8KNXP-Ultra motherboard, the most insanely feature-laden board we have seen. It even has onboard SCSI.**

Crossing first

In one sweeping gesture Intel has managed to deliver a chipset that makes us ponder why they ever bothered with the corporate miasma that was its deal with Rambus.

Dual-channel DDR manages to deliver astonishing bandwidth without falling back on obscure and expensive technology. The major issue at the moment, and the one major barrier to the success of the i875P, is the infancy of DDR400.

While increased processing power and bandwidth is all very good, stability will remain a big concern for memory and CPU makers alike.

It will take a few months for widespread availability of DDR400, which means that people wanting to take advantage of the boosts delivered by PAT will have to wait. The good news is that Intel plans to deliver a wide spread of 800MHz FSB Pentium 4s to complement the 3GHz model that is currently shipping. By the time these become available we should also see enough DDR400 to satisfy the masses.

The i865 series deserves to become a mainstream success. Even though the chipset lacks the PAT technology of its performance brother, you can still get a great deal of speed and power out of DDR333, which is now plentiful in the marketplace after an admittedly slow start. Those who demand or need the absolute most out of their machine (and lets face it, why bother with average performance no matter how good it is – you now there's still better) will want to wait until they can get the holy trinity of an 800MHz frontside bus Pentium 4, dual DDR400 and an i875P motherboard.

For the rest, who are happy with gut-tumbling and mind-spinning but not head-exploding speed, the key to blazing performance is the i865.

SUB-STANDARD:

DDR400 is still to be ratified as a standard by the JEDEC, leading to what is becoming an all too common picture. VIA and SiS both released DDR333 supporting chipsets before an official standard was available, SiS had AGP 8x video and system chipsets a good six months before Intel ratified the final AGP 3.0 spec, now Intel is pushing a technology based upon a draft standard.

As a result of all this tomfoolery, JEDEC is becoming increasingly irrelevant. One of the companies, Computer Memory Test Labs (CMTL), which is used by chipset manufacturers such as Intel for compliance testing, has recently announced that the JEDEC DDR specifications will no longer feature in its testing.

This is incredibly problematic because the transition between memory types has historically resembled the Wild West.

A case in point is the huge increase in RAM targeted at the overclocker market.

One particular example is Corsair's incredibly popular (and incredibly good) XMS range of products. Corsair makes memory designed to cope with higher than normal frontside buses, which caused it to launch its overclocker DDR333 under the chunky XMS3200 moniker.

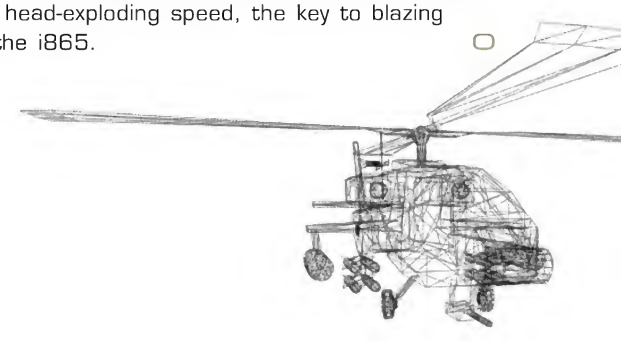
This RAM may run on a 400MHz FSB, but that doesn't make it DDR400. The new standard contains revisions to signalling modes to enable higher frequency performance, something that does not factor in to the overclocking memory.

This has lead to the huge outcry over VIA's KT400 chipset, which had huge issues dealing with the supposedly supported DDR400 standard.

VIA has since shied away from DDR400 support in that chipset because there were literally dozens of 'proper' DDR400 modules worldwide at the time, existing only as delicate engineering samples.

To avoid weird problems with RAM compatibility, and to cope with the increasing move away from JEDEC standard compliance, most motherboard and chipset manufacturers now host lists of 'compliant' memory on their Websites. The most common ones can be found below:

Intel www.intel.com/technology/memory/ddr/valid/overview.htm
VIA (DDR333 only) www.via.com.tw/en/ddr/ddr_validation.jsp
SiS www.sis.com/ddr/ddr_validation.htm
NVIDIA www.nvidia.com/content/nForceMemoryCompatability/lstnForceMemoryCompatibility.asp.



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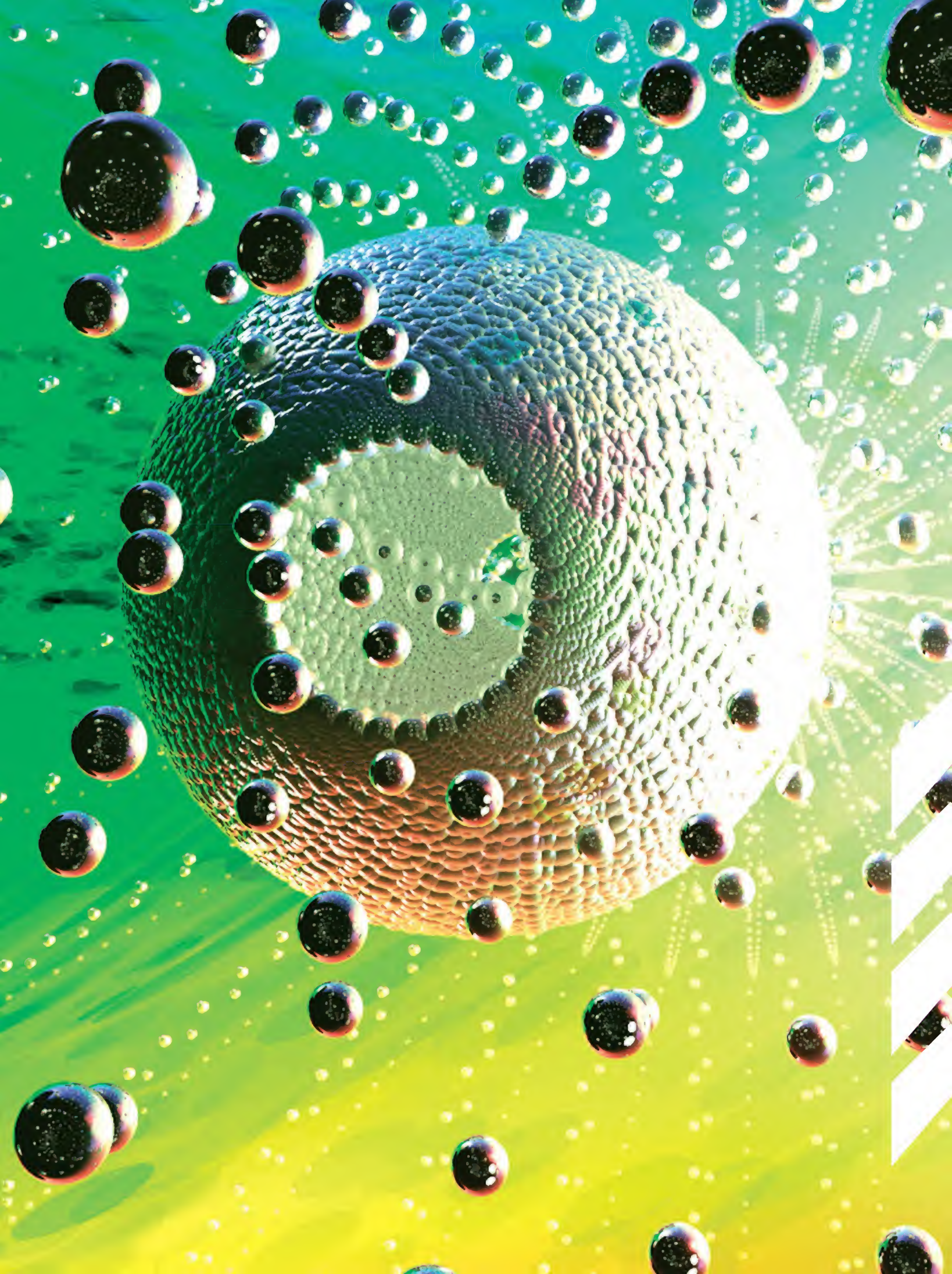

Sinking feeling

What do motherboards and evolutionary theory have in common?

John Gillooly dons his Scientician costume and investigates.

One of the fundamental parts of evolutionary theory is the notion of 'arms races' – the leapfrogging of evolutionary advantages between predator and prey as new mechanisms for avoiding being eaten or bypassing these defences evolve.

For example, if a plant grows long toxin-coated spines to stop it being eaten by birds the evolutionary trend will be towards birds with longer beaks, as short-beaked birds die from trying to get at the sweet nectar. As the sweet nectar gets drained from short spined plants by long beaked birds, the plant will tend towards longer spines, and so on and so forth.

Another big driver of evolutionary trends is sexual competition. In a lot of species dominant males will have the most bulbous red buttocks, the most colourful feathers, or the biggest horns. This is a form of display, and drives evolution as the more sexually appealing members of a species get more mating action, and in turn have more offspring which in turn, carry these traits to a new generation.

Before my colleagues make that phone call to book me in for a short holiday at the local sanatorium, I need to point out that there is actually a point to all this. The evolution of the PC components over recent years closely resembles nature. For the battle has been fought on two fronts; performance and appearance.

When we first started *Atomic*, motherboards and video cards looked very different from what we see now. Hercules products were instantly recognisable due to the use of blue PCBs rather than the usual green or pale brown; ABIT motherboards always came with an IDE RAID option and BIOS-based overclocking tools that were almost unheard of; AOpen had even gone so far as releasing a black motherboard, albeit as a very limited edition. It seemed that every manufacturer had a hook, a way of differentiating itself from the pack, but no one had the entire feature-set on a single board.

This has turned on its head in what seems an insanely short time, just one and two-third turns of Moore's Law's clock. Now it seems insane for a manufacturer to release a retail board that doesn't have every bit of real estate filled with additional controller chips and extra ports.

Mobos that lack BIOS overclocking tools are rare; multiple RAID controllers are common; onboard audio is not only widespread, it no longer sucks arse; onboard Gigabit Ethernet is becoming common; and it is almost a given that USB 2.0, FireWire and the like will be supported via a backplane.

Even technologies like thermal monitoring are everywhere. Each manufacturer has a slight twist on the theme, but they all have something. There are few technologies like Gigabyte's Dual BIOS that remains proprietary (legal action by Gigabyte has stopped others launching similar features in the past), but generally there is little to differentiate between manufacturers in the feature stakes.

Now that there seems no angle left to take in the arms race, focus has now turned to something that resembles sexual competition. While we have become more and more accustomed to multi-coloured PCBs which have even spun off into Triplex's Millennium Silver-series, Soltek's garish 'gold' mobos, and DFI, who is soon to launch a range of glow-in-the-dark motherboards.

But I think the latest additions push the boundaries a little too far, with the introduction of glowing motherboard and video card bits. Gigabyte came first with blue LEDs mounted on the chipset cooler used for its Dual Power system riser board, which gives off a constant blue glow, but the latest developments go much further.

We have seen boards now from several manufacturers that use multi-coloured LED lighting on their Northbridge coolers. What's more, these lights are set to oscillate in a series of patterns that gets wackier and wackier by the second. Which is cool for a period of time that is slightly shorter than a picosecond.

If the insanity doesn't stop the careful use of case lighting will become redundant as the sleek cold cathodes compete with strobing LEDs mounted on anything that draws a current. I am all for lighting as a complementary part of case modding, but do we really need mobo makers forcing it down our unwilling throats?

At least the builders of third-party Northbridge coolers should make a pretty penny.

artomic

"sphereAdelic" By Jarrod Blomberg aka 'JarrodB'

The image was done with POVRay (http://www.povray.org) and helixir (http://www.evolve.co.uk/helixir/). I created a mesh using Helixir and exported it to a text file. I edited the exported file and changed every co-ordinate of the 47,000 odd trianlges to a shiny chrome ball. Slapped on some lighting and moved the camera around to get the funky pic I wanted. There were no touch ups with any other program.

Please feel free to visit my gallery at 3D commune where I am a mod in the Poser forums.'

Create the winning Artomic and win the latest version of Indesign and Acrobat from Adobe! Email a preview (no larger than 5MB) of your games- or hardware-themed masterpiece to artomic@atomicmpc.com.au.

atomic benchmarks

At *Atomic*, it is our primary intention to give you the final word on the latest in hardware and PC technology. An integral part of determining the performance of a particular piece of hardware is benchmarking, and this is something that we take very seriously in the *Atomic* Labs.

SYSmark2002

SYSmark2002 is a product of the collaboration between industry group BAPCo (www.bapco.com) and MadOnion.com (www.madonion.com). It is one of the next-generation application benchmarks and is designed to more accurately replicate the day-to-day workload that a system is subjected to. The focus of the benchmark is on Internet Content Creation and Office Productivity tasks, which combine to produce a final performance rating.

Unreal Tournament 2003

UT2K3 is the latest and greatest first person shooter from Epic. The game makes use of the new Unreal Warfare engine, and as such is a perfect benchmark for system performance. We use HardOCP's (www.hardocp.com) benchmarking utility to run a series of flyby benchmarks at varying resolutions to test performance. The utility also features support for a low resolution/high geometry CPU test. Results are in average frames per second.

3DMark2001SE Pro

3DMark2001SE Pro from MadOnion.com is the next progression of the popular benchmark utility. It also uses the MAX-FX engine and heavily emphasises DirectX 8.1 functions, including programmable shaders. The results are not comparable with results from 3DMark2000 Pro.

Serious Sam: SE

Serious Sam: The Second Encounter is used for testing OpenGL performance. For game tests we use the Cooperative demo, which outputs an average framerate trimmed of excessive peaks. It also contains a fillrate test, which outputs fillrates for various texturing methods and is useful for making comparisons between video chipsets.

HSF testing – Chernobyl

To test heatsink fans we use our custom engineered CPU replicator, known as Chernobyl. This beastie pumps a variable wattage through a solid Copper CPU die replica, with a temperature probe mounted in the exact centre of the die replica. Chernobyl results are not directly comparable with real world temperatures, but do provide a very accurate benchmark.

Quake 3: Arena *AtomicMPC* demo

Quake 3: Arena (Q3A), from id Software, is a very popular first person shooter, and represents widely used OpenGL gaming technology. Q3A has a built-in benchmarking utility and built-in demos that can test graphics card performance. These demos are fairly simplistic, so we developed our own *AtomicMPC* demo that pushes the hardware as far as possible.

Other benchmarks

Sometimes we need to break down the tests into more specific areas, such as hard disk performance, memory performance, or a particular facet of 3D, such as T&L. We can draw on a vast number of applications, games and dedicated benchmarks such as CD Speed 99, DisplayMate, Dronez, MDK2, or Adaptec ThreadMark to perform these tests. We also use a Lian Li temperature probe from Anyware (www.anyware.com.au) for tests that involve the measurement of temperatures, such as HDD heatsinks.

Atomic Hot Award

The *Atomic* HOT award is given only to the most kickarse products to hit the Labs, ones that score 9 or greater.

Atomic testbench specs

Both test systems use Windows XP Professional with Service Pack 1, DirectX 8.1 and the latest chipset and video drivers.

- **AMD Athlon XP 1800+ system – ASUS A7V266-E motherboard (supplied by CASSA:** www.cassa.com.au**)**
- **Intel Pentium 4 2GHz – ABIT BD7II-RAID motherboard (supplied by ABIT:** www.abit.com.tw**)**

Common components

- **Corsair TwinX XMS3200 matched dual-channel DDR-RAM (supplied by Altech** www.altech.com.au**)**
- **Hercules Prophet II GTS 32MB (supplied by Guillemot:** http://au.hercules.com**)**
- **64MB Apacer memory keys (supplied by Anyware:** www.anyware.com.au**)**
- **Hercules Prophet II GTS 32MB (Supplied by Guillemot:** www.hercules.com**)**
- **Sound Blaster Live! Player (Supplied by Creative Labs Australia:** www.creaf.com**)**
- **ASUS 52x CD-ROM (supplied by CASSA)**
- **Belkin PCI FireWire card (supplied by Belkin:** www.belkin.com.au**)**
- **Belkin PCI USB 2.0 card (supplied by Belkin)**

Benchmark settings

3DMark2001SE Pro

- **1,024x768; 16-bit colour; 16-bit textures; 16-bit Z-buffer; triple frame buffer.**
- **1,024x768; 32-bit colour; 32-bit textures; 24-bit Z-buffer; triple frame buffer.**
- **1,600x1,200; 16-bit colour; 16-bit textures; 16-bit Z-buffer; triple frame buffer.**
- **1,600x1,200; 32-bit colour; 32-bit textures; 24-bit Z-buffer; triple frame buffer.**

Quake 3: Arena *AtomicMPC* Demo

All tests use Quake 3: Arena 1.27g and our custom Q3A demo recorded by the *Atomic* staff.

- **CPU testing: 320x240; maximum geometry detail; minimum graphics settings; high sound quality.**
- **Graphics cards: Low quality – 1,024x768; normal quality graphics settings; sound disabled.**
- **Medium – 1,280x1,024; maximum graphics settings; with all game sound disabled.**
- **High – 1,600x1,200; maximum graphics settings; with all game sound disabled.**

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Microsoft Windows XP Home
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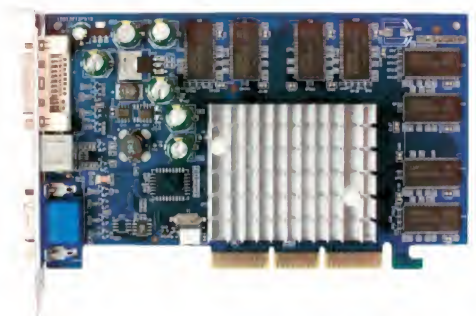
Framerate

Sucked in by the fanfare? Don't be. It's 5200 madness on the market this month, with the chips flowing faster than a flood in Germany. Nothing on the RADEON front though. Well, nothing except the 9800. Which is actually something. Special.

Sparkle GeForce FX 5200

SPECIFICATIONS: GeForce FX 5200 GPU; AGP 8x; TV-out; 128MB DDR-RAM
CORE SPEED: 250MHz MEMORY SPEED: 400MHz PRICE: $198
WEBSITE: Sparkle www.sparkle.com.tw
SUPPLIER: Australia IT www.australiait.com.au

The GeForce FX 5200 will become more and more common over the next few months as NVIDIA pushes its philosophy of top-to-bottom DirectX 9 support throughout its range of graphics cards.
Sparkle's offering differs from the others we have seen in that it uses slower-rated memory, not a problem at stock speed but it will hamper overclocking attempts.



Albatron FX5200P

SPECIFICATIONS: GeForce FX 5200 GPU; AGP 8x; TV-out; 128MB DDR-RAM
CORE SPEED: 250MHz MEMORY SPEED: 400MHz PRICE: $189
WEBSITE: Albatron www.albatron.com.tw
SUPPLIER: AMI Computers www.ami-computers.com

Albatron's GeForce FX 5200 card is a solid budget offering, but suffers the same problems as the entire FX5200 range. Namely the performance is somewhat underwhelming, being clearly beaten by the almost as cheap Ti4200 cards. However the passive cooling and TV out on this card makes it a potential winner in the home theatre PC stakes.

ABIT Siluro FX5800 OOTH Deluxe

SPECIFICATIONS: GeForce FX 5800 GPU; OTES III cooling system; AGP 8x; TV-out; 128MB DDR-II RAM
CORE SPEED: 300MHz MEMORY SPEED: 600MHz PRICE: $850
WEBSITE: ABIT www.abit.com.tw
SUPPLIER: Altech www.altech.com.au

Following on from last year's outstanding GeForce4 Ti4200 with patented OTES cooler, ABIT has used the third generation of this cooling technology for its GeForce FX 5800 card. However it lags well behind the RADEON 9700 and 9800 series in the price/performance stakes.

Sparkle Ti4200-8x Platinum

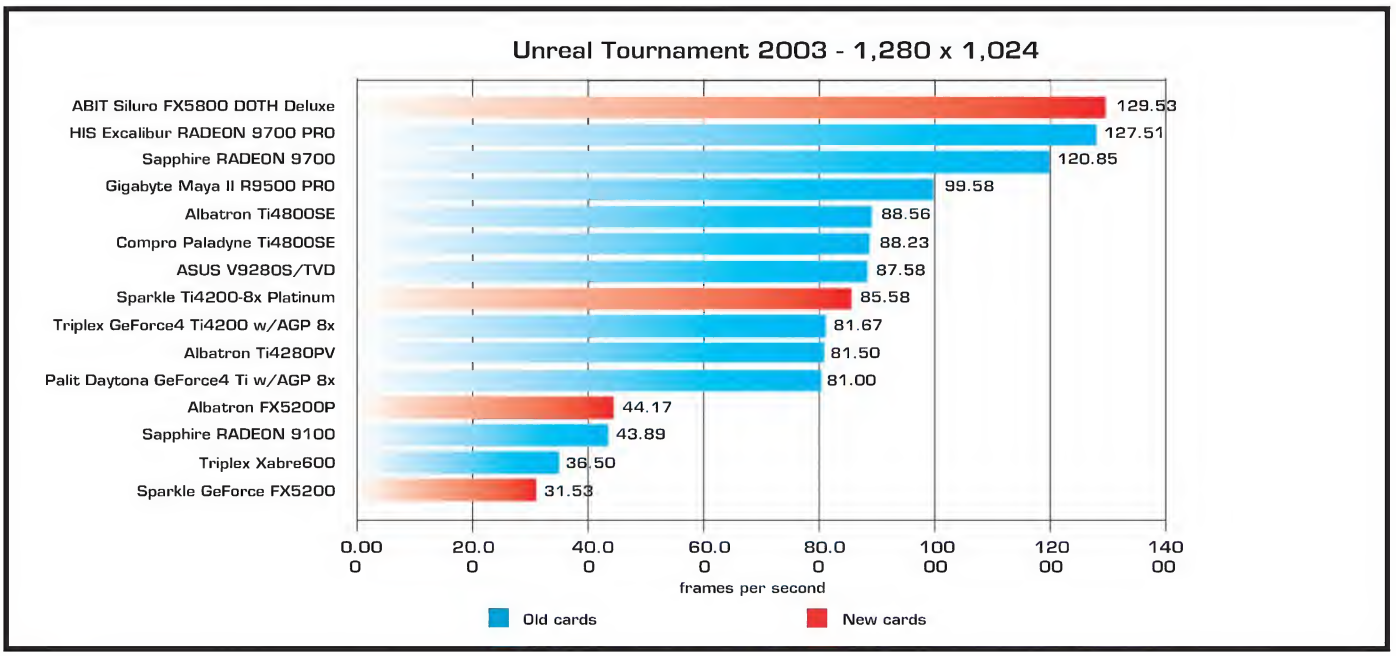
SPECIFICATIONS: GeForce4 Ti4200 GPU; AGP 8x; TV-out; 128MB DDR-RAM
CORE SPEED: 250MHz MEMORY SPEED: 500MHz PRICE: $850
WEBSITE: Sparkle www.sparkle.com.tw
SUPPLIER: Australia IT www.australiait.com.au

Sparkle's GeForce4 Ti4200 with AGP 8x offering comes with a snazzy blue Aluminium heatsink that looks like it has all the thermal efficiency of a piece of wet newspaper. A very wet piece of newspaper. The card runs fine though, and delivers that great performance that has helped the Ti4200 hold a special place in our hearts.

Video cards

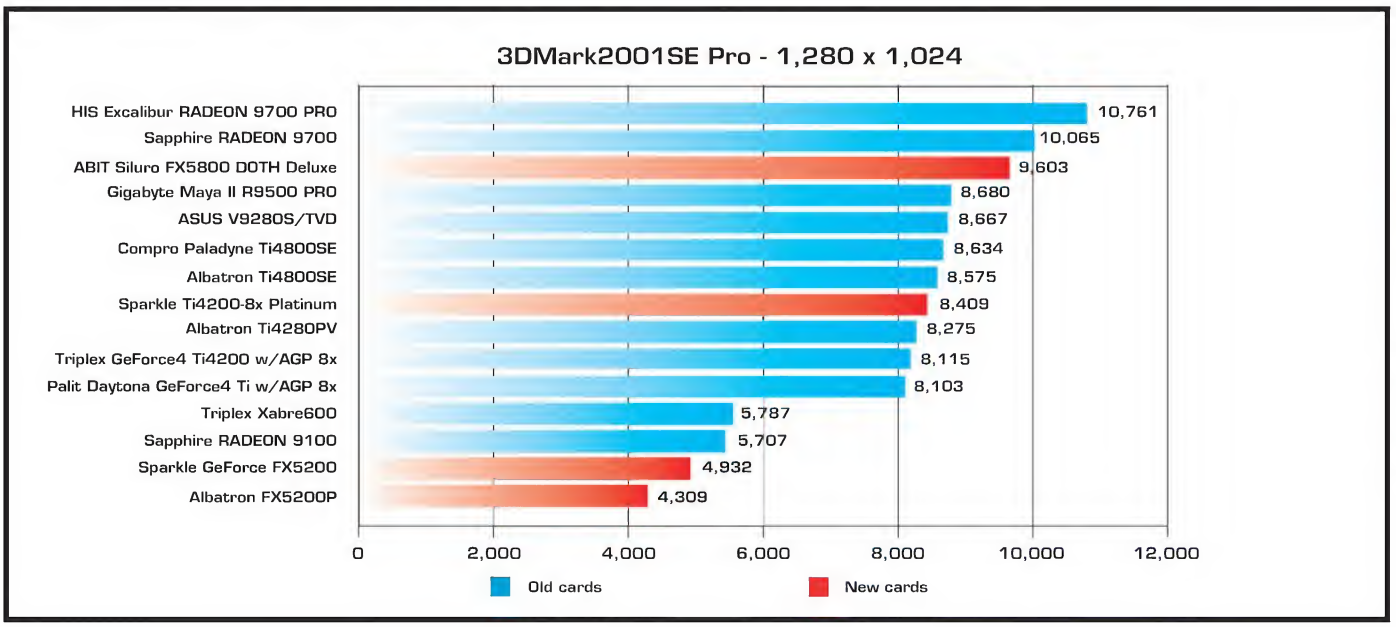
Even though we are yet to see volumes of GeForce FX 5800 or 5600 products shipping to retail, NVIDIA are pushing ahead with the launch of its new chip, codenamed NV35, during the E3 event in Los Angeles. This should hopefully help to regain some of the credibility with performance users that has been damaged with the GeForce FX production and performance woes. Of course, we have to wait to see how long the gap between product launch and actual products will be before we make a final judgement.

ATI is already rolling out its re-jigged RADEON line, with the RADEON 9800 PRO and RADEON 9200 starting to appear, but still little sign of the 0.13-micron-based RADEON 9600 series, which will be the real test of how quickly ATI can make the transition to the manufacturing process that NVIDIA has struggled with over the past year.
Other graphics manufacturers have been very quiet of late, but Matrox seems set to release cut-down Parhelia boards sometime soon, however these will be aimed at the corporate, not gaming market.



CPUs

The 800MHz FSB for the Pentium 4 has now landed in the form of the 3GHz C variant, and with it decent performance gains thanks to the accompanying i875P and i865-series of chipsets and the magic of dual-channel DDR-RAM. To see just how well this chip does, check out our feature on *page 46*.
This is not to say that AMD is doing nothing, in fact it has been very busy of late. The new Hammer architecture has finally arrived, after a quick name change to AMD64, in the form of the Opteron 200-series. We still have to wait until September for the consumer-level Athlon 64, and the one and eight way Opterons, but at least AMD has finally delivered something based on AMD64.
Desktop users have not been neglected though, with the release of a 400MHz FSB Athlon XP 3200+ CPU, designed to be paired with the newly credible DDR400 memory. Accompanying this are revamped nForce2 chipsets from NVIDIA, the nForce2 400 and nForce2 Ultra 400, which add official support for the 400MHz FSB and a small performance boost, but no other major changes over previously released nForce2 motherboards.



Leadtek Quadro FX2000 <<<

Groovy graphics guru Ivon Smith has taken the new Quadro for a spin. Try to excuse the less than complete windshield and missing headlight.

Everyone gets very excited when a new graphics chipset comes out. We drool at spec sheets and performance promises, along with all the new features that will make our lives, as 3D artists and gamers, much more fun, exciting, productive and creative.

Arguably one of *the* most anticipated GPU releases for ages has been NVIDIA's FX series (NV30). The gaming version, GeForce FX, was released first among much hoo-hah about real-time texture rendering, cloth and skin deformation and claimed massive amounts of polygon-pushing and unprecedented frame rates. *Nice try!* As most of us have seen in tests rife throughout the media, the GeForce FX didn't kick butt as much as most of us were hoping, or were lead to believe it would. And one of NV30's claims to fame, DirectX 9 rendering effects, also will not be available in games for a long time yet.

Slightly later in the release timeline, with perhaps as much industry-targeted hoo-hah and a much inflated price entry point is the professional 3D DCC version of the NV30, the Quadro FX. Until the release of ATI's FireGL X1, NVIDIA's Quadro series (headed by the 980 XGL) were pretty much the most powerful OpenGL cards on the market for CAD, 3D modelling and animation, 3D visualisation, film and TV work, trouncing all the competition in benchmarks as well. *Very good stuff!*

Enter Quadro FX. 128MB 400MHz DDR-II memory; 400MHz chip speed; AGP 8x; 128-bit floating-point precision pipeline; 128-bit colour; 125 million transistors; 12-bit subpixel precision; 16x FSAA; CineFX shading architecture; up to 3,840 x 2,400 display resolution; dual-DVI digital outputs and 3D volumetric texture support for medical visualisation and solid-modelling applications. NVIDIA's own programming language for OpenGL and DirectX display effects, Cg, is supported and enhanced in the Quadro FX family, promising realtime photorealistic effects within 3D design environments. Working with the top 3D application manufacturers, NVIDIA has developed the Quadro FX to offer advanced realtime shader effects, to help speed production pipelines so game developers can see their in-game textures and effects in the creation application, or 3D production designers to visualise their engineering products easily.

CAD applications, such as AutoCAD, ProEngineer, SolidWorks and Unigraphics should benefit from enhanced geometry handling capabilities, and DCC applications (used extensively in the games, TV and film industries) such as 3dsmax, Maya, SoftimageXSI and Houdini will all be able to display better quality, more effects-laden and complex models, improving the design process in demanding areas such as 3D character animation.

So, how did the FX2000 actually stack-up against the competition in benchmarking? And even more importantly, how did the card (and drivers) perform in real-world applications?

The test 3D workstation was a dual AMD MP2000+, with 1.5GB DDR266, ASUS A7M266-D motherboard, dual-18in Samsung LCDs, and Windows XP SP 1.

The FX2000 ranked alongside its archrival, the FIREGL X1, and my usual 3D workstation card, the slightly more modest 3DLabs WildcatVP870. Industry standard benchmark tests were performed, but the cards were also compared for power and stability in a general working 3D environment and my own custom 3D test scenes within 3dsmax 5.1.

The VP870 is usually stable, reliable and fairly smooth in its 3D usage, Photoshop and even the general Windows environment. We were pleasantly surprised and quite impressed by the workflow capabilities, features, speed and stability of ATI's offering as well, producing naught but the odd artifact and wireframe glitch in many days of 3dsmax 5.1 production work.

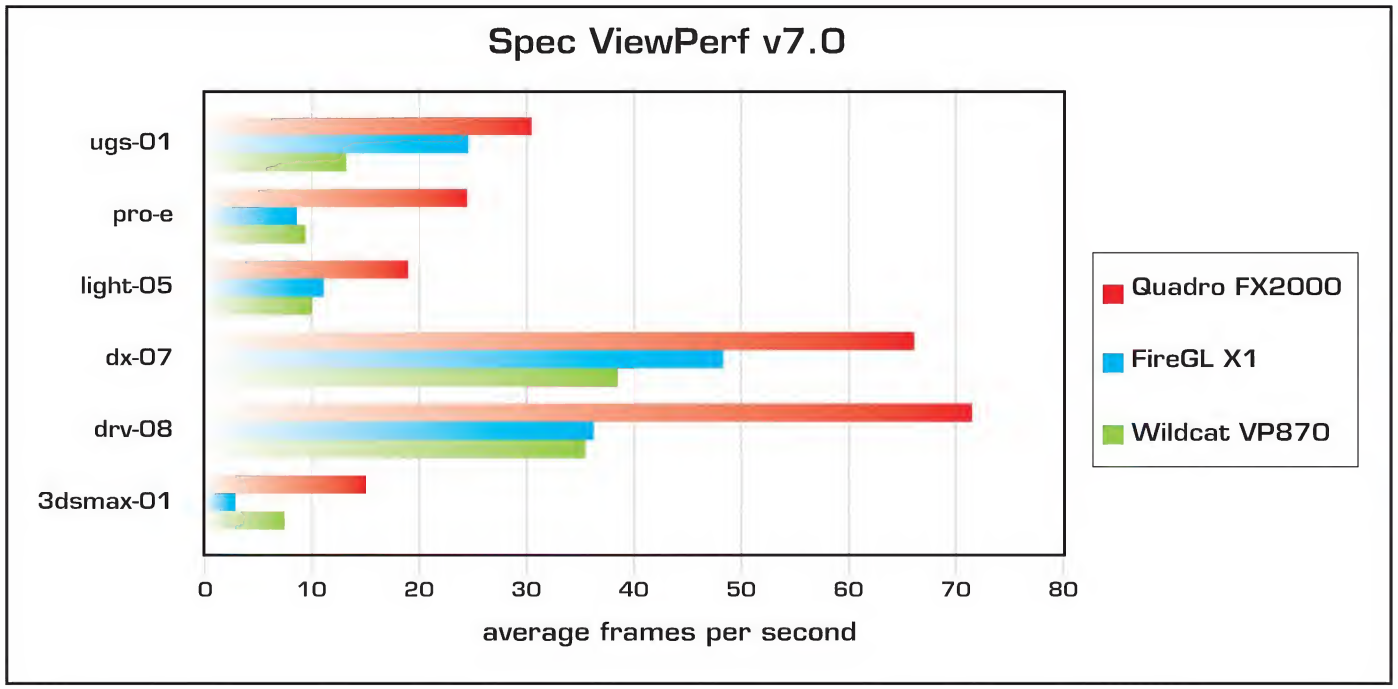
When it came to the FX2000 and the Detonator drivers, it was, at first, 'Houston, we have a problem.' The card and the standard NVIDIA drivers seemed to have an issue with my workstation and its Windows XP environment. Not only did the card operate very sluggishly, creating glitches and instabilities in 3dsmax and Windows, but eventually it refused to work at all, totally corrupting the system, necessitating an entire Windows reinstall! Ouch.

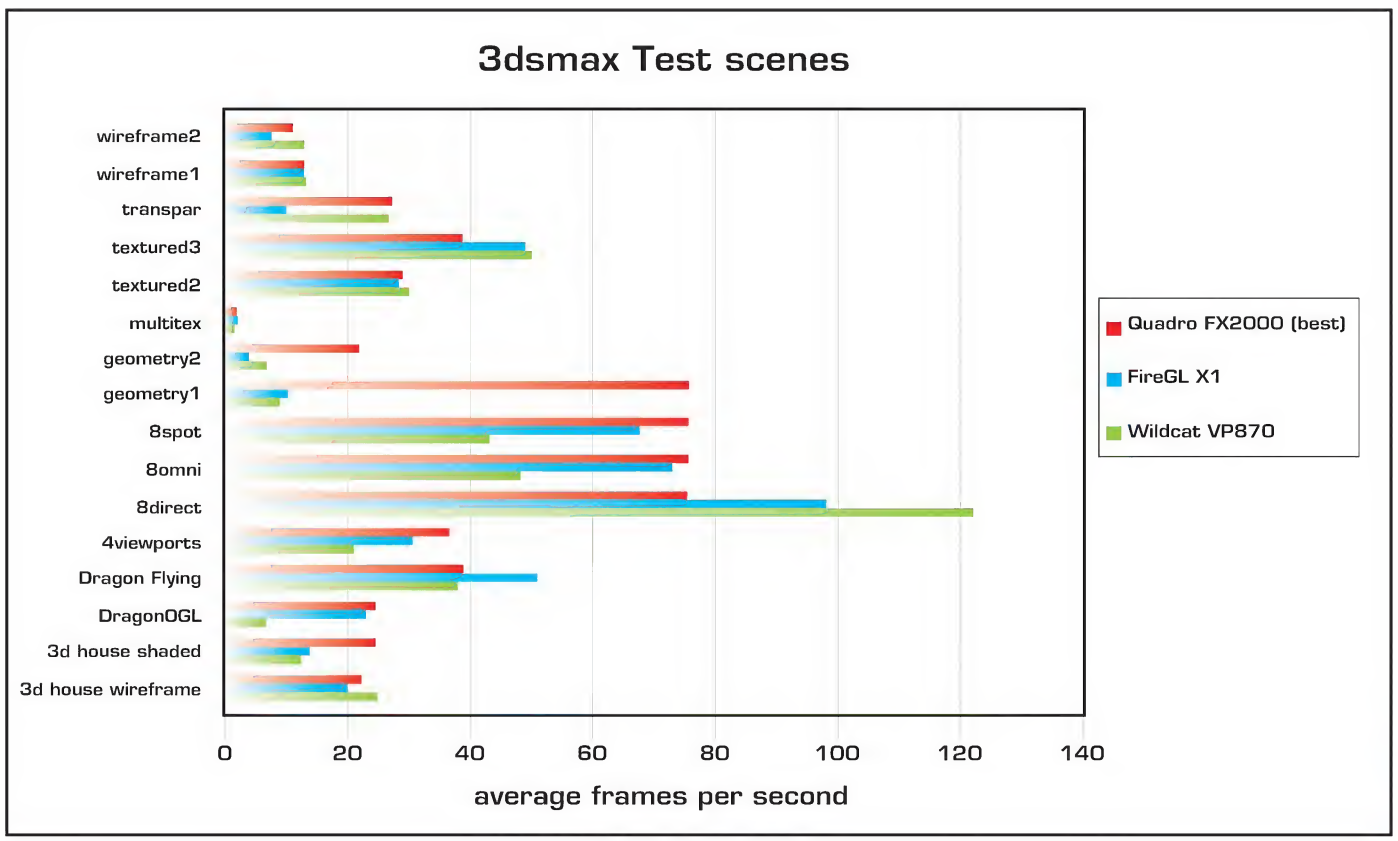
Following technical advice from NVIDIA and Australian manufacturers of the FX2000, Leadtek, Windows was reinstalled, and the latest *certified* drivers for 3dsmax were used. Notoriously, the driver certification process is one of the main things we, as 3D designers, pay for when buying OpenGL cards, the FX2000 not giving much change out of $3,000.

Why this is the case was apparent once I used these certified 3dsmax drivers. Stability was restored and we were in the land of super smooth! In 3dsmax 5.1 the speed and power of the card became evident, ripping through hours of production work with ease. For example, my custom benchmark scene, 3dhouse.max, is an architectural model of 200,000 polys.

The FX2000 ate this alive, smoothly navigating the scene, fully textured in realtime! Very nice. I cannot overemphasise the importance of *actual* performance in 3D applications over benchmarks which can be focused on specific strong or weak points inherent in a particular OpenGL card architecture.

Having said that, the relative performance in SPECviewperf V7.0 was pretty darned impressive too, with the FX2000





besting the FIREGL X1 in all tests by between 20% and 200%+. Note that the specific values are limited by overall system performance, but the score shows how the FX2000 performed in relation to the other cards.

The 3dsmax 5.1 test scenes showed a mixed bag of results, the FX2000 easily showing its superiority in shaded polygon geometry handling features, whereas the FIREGL X1 demonstrated that it is still easily worth its more modest asking price in handling lights and complex texture maps.

The FIREGL X1 was a great card to work with. The Quadro FX2000, once stabilised, proved to be a stunning card to work with! It'll be on my Christmas list, along with that Ferrari again!

Specifications:

NVIDIA Quadro FX2000 GPU; dual DVI outputs; 128MB DDR-II RAM.
Website: Leadtek www.leadtek.com.tw
Supplier: BCN Technology www.bcntech.com.au
Phone: BCN Technology (02) 9648 0039
Price: $2,995

HOT atomic MAXIMUM POWER COMPUTING

9.5/10

Shuttle MN31N <<<

When somebody mentions the Micro ATX form factor, the brain is naturally drawn to images of poorly featured integrated graphics setups with the cheapest available SiS chipset. But the leap to quality is not that far, as was seen with the extremely limited release of Micro ATX boards with NVIDIA's original nForce.

Thanks to Shuttle, we now have the option of grabbing a feature-laden Micro ATX board based upon the current speed champion, the nForce2. The MN31N employs the Integrated GeForce4 MX version of the nForce2 chipset and is focused upon stability and flexibility rather than squeezing the best overclock out of your new Thoroughbred Athlon. This is not a disadvantage however, as the environments in which we performance users want a Micro ATX board are usually ones where silence and economy of space take importance.

Quite a number of Micro ATX cases have passed through the Labs recently, and nearly all of them are destined to become home theatre PCs designed to fit in with existing Hi-Fi components. For this use the nForce2 is perfect, with high quality audio output and a wide range of features such as IEEE 1394 and USB 2. It also features dual D-Sub monitor outputs for nView support, but like all the other nForce2 boards (apart from Shuttle's Mini ITX board) it lacks TV-out. This simple functionality would make the MN31N phenomenally feature rich; as it stands you will need to use the AGP slot to mount a video card with TV-out if you want to use it as a home theatre box.

Because the nForce2 is such a good performer, this would also make a great inclusion to a LAN box: Sure, the overclocking functionality of higher end boards isn't there, but this is still the fastest Athlon chipset, and it's easy to add a better video card.

Yet again Shuttle has brought us sorely needed functionality in an oft-neglected market segment. The MN31N is fast, stable and feature packed, without being super expensive. It *is* a kick arse offering, but if it had TV-out support it could have been the perfect Micro ATX mobo. JG

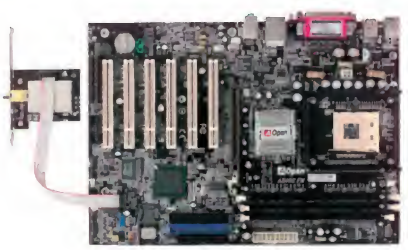
Specifications:

NVIDIA nForce2 with IGP and MCP-T; AGP slot; three PCI slots; dual Ethernet; 5.1 audio support.
Website: Shuttle www.shuttle.com
Supplier: SATO www.satotech.com.au
Phone: SATO (03) 9899 6333
Price: $220

HOT atomic MAXIMUM POWER COMPUTING

9/10

AOpen AX4GEFM



A couple of years ago the concept of mounting an FM radio inside a PC would have been called redundant thanks to the broadband explosion and Internet radio. No longer would the hits of the 1970s, '80s and '90s be the only option when the MP3 collection got boring. With streaming radio you could finally sit down and listen to that 24-hour Black Metal station from Norway you'd heard so much about. Kiss those eardrums goodbye.

Restrictive broadband caps and the inability for record companies to cope with new technology mean that streaming radio is no longer a perfect option.

AOpen's solution is to include an FM radio tuner with its latest i845GE motherboard. The tuner comes as a blanking plate with an aerial connector, hooking up to the motherboard through a USB header.

It is operated either through AOpen's Jukebox FM software, which is OS-independent and is selectable as an option after boot; or the bundled FM software for Windows, which includes support for recording radio programs to WAV files. That is the totality of the FM radio experience – dude.

The tuner works well and the software is easy to use, but one cannot help but wonder why an FM radio tuner is seen as an essential add-on to your PC, especially considering the low cost of separate FM radios and the prevalence of FM support on TV tuner cards.

Those wanting to record regularly from the radio may see the benefit of the AX4GEFM; others will more likely look to the benefits brought by the new generation of Intel chipsets for their system satisfaction.

With the motherboard feature race ramping up to insano levels, the AX4GEFM is poorly positioned to take on its feature-heavy competition.

AOpen's decision last year to build the Tube motherboard was inspired – but the AX4GEFM is pure gimmick. Heck, even those dodgy exercise machines advertised on early morning TV now come with free FM headsets, so hopefully this isn't an indication of the motherboard market starting that slide. JG

Specifications:

i845GE chipset; FM radio tuner; 800MHz FSB support; DDR333; AGP 4X support.
Website: AOpen www.aopen.com
Supplier: Blue Chip IT www.bluechipit.com.au
Phone: Blue Chip IT (02) 8745 8400
Price: $320

6/10

THE JOURNEY STARTS HERE...

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Linksys Wireless-G broadband router

In the nefarious world of Wi-Fi standards 802.11b is still king, despite its low bandwidth of only 11Mb/s. The competing 802.11a standard offers up to 54Mb/s, but apart from some dual standard supporting hardware, it has not received the support expected thanks to the prominence of 802.11b and general lack of interoperability between the two. Because of this the draft 802.11g standard is the basis for Linksys' new range of Wireless-G products. The 802.11g has the benefit of being backwards compatible with 802.11b while being capable of delivering 54Mb/s bandwidth. This capability is a cornerstone of Linksys Wireless-G broadband router, combining a four-port 10/100 Ethernet switch with a router.

Setup is simple, plug in the devices, switch them on and fire up a browser so that you can access the configuration pages via a Web interface from one of the wired PCs on your network. Setup will vary depending on your ISP but for OptusNet cable it really was just plug and play.

You also configure the Wireless Access Point, including those all important WEP security settings, through the browser which is a straightforward affair.

With PCs running default Windows XP network settings, detection of the network and the Web that lay beyond was a doddle, working reliably from boot. If the PC had other settings then a quick rerun of the Windows networking wizard was enough to get everything running smoothly.

In fact our only real worry with the Wireless-G was the draft nature of the standard.

While backwards compatibility with 802.11b seems to guarantee the future success of 802.11g, recent shenanigans with DDR memory and AGP 8x has made us wary of products that adopt standards before finalisation. For a home network, the issues are much less than a corporate deployment.

The Linksys Wireless-G is a great little product; when the standards get ironed out it could well be the unbeatable all-in-one solution for your home networking needs. JG

Specifications:

802.11g Wireless Access Point; four-port 10/100 Ethernet switch; broadband router
Website: Linksys www.linksys.com.sg
Supplier: Ingram Micro www.ingrammicro.com.au
Phone: Ingram Micro 1300 65 3333
Price: $329

8/10

Antec Sonata

We've seen PC cases evolve rapidly over the last couple of years, from boring beige hunks of steel, to Aluminium wind tunnels, and now to tiny shoeboxes. Something we haven't seen a lot of, which seem to be in high demand, are cases that focus on reducing noise. The Sonata is the first case we've seen that pays special attention to getting rid of the annoying hums and whirrs we've all learnt to live with; well, that's according to Antec.

Instead of mounting four or five high-speed blenders to get air flowing through the case, the Sonata has just two mounts for case fans. These are designed to hold 120mm fans, allowing for decent airflow at a much lower noise level. Unfortunately only one 120mm fan is included with the case. The other feature that helps to reduce noise is the rubber grommets used for mounting hard drives. While these do help to reduce the vibrations passing from the hard drive to the case, they do nothing to cover up the internal noise of the hard drive's platters spinning, which is the main cause of noise from today's relatively high rpm drives. What the Sonata really needs is some kind of sound insulation material surrounding the disk bays. Oh well, maybe next time.

Other than these two features, the Sonata is a pretty stock-standard PC case. It has a nice shiny black paint job, a couple of USB 1.1, FireWire and sound ports on the front hidden by a little fold down door, and a total of nine drive bays. Strangely, the bays are all rotated 90 degrees to the left, so that your IDE cables are all easily accessible from the removable side of the case. However the right section of the case cannot be taken off and is a killer flaw, especially considering there's no removable motherboard tray.

The TruePower 380W PSU is welcome, as these power supplies are some of the most reliable available.

For a case that claims to reduce noise levels, the Sonata doesn't come through with the goods. If Antec had included sound absorbent lining, which wouldn't cost a great deal to implement, or some other form of sound reduction, we're sure it could have delivered a great product. As it is, the Sonata is a very average case at an above average price. BR

Specifications:

Two 120mm fan mounts; nine drive bays; 380W TruePower PSU.
Web site: Antec www.antec-inc.com
Supplier: Altech www.altech.com.au
Phone: Altech (02) 9735 5655
Price: $250

7/10

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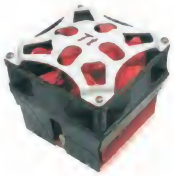

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Thermaltake Volcano 11 Xaser Edition

Vulcan. Raumoko. Hephaestus. Thermaltake. Spot the odd one out. The savvier of you might have suggested Thermaltake – but you'd be wrong. You see, there is no odd one out – all are gods of Volcanoes.

It seems Thermaltake have been a bit more productive of late than these other slackers, and have just released the Volcano 11 heatsink fan. Nyuk. Nyuk.

The biggest change over its predecessor, the Volcano 9 (WTF happened to the Volcano 10?), is that the base is now built entirely of Copper, unlike the Aluminium hybrid construction of the Volcano 9. Still chocked with features, whether or not these are worthwhile is debatable. The best of these is a fan speed control knob allowing you to manually set the speed of the fan from 1,300rpm to 4,800rpm. Of course, at the lowest speed the unit cools about as well as a sweaty sock, but more about that in a minute. Another feature is a temperature probe that automatically controls the fan speed for you. At 20C, the fan is at it's lowest speed, hitting full speed when the temperature reaches 55C.

The heatsink clip is notable for its ease of use, as well as the fact that it uses every lug on the CPU socket. This is reassuring for those of us who have been through the agony of losing the centre socket lug due to a dodgy HSF clip.

Upon testing the Volcano 11, we of course put it up against the Thermalright SLK-800, the undisputed leader of Heatsink Land, paired up with the beastly Delta EFB0812HHE 80mm fan. Ambient temperature was a constant 20C throughout the test.

At the lowest fan speed, the Volcano hit a whopping 79C – basically useless. However, at the highest fan speed, this was a much cosier 62C, but the fan was almost as loud as a Delta at this speed. This sounds like a reasonable temperature. . . until you compare it to the chilly 47C that the SLK-800 managed to cool our test bench to.

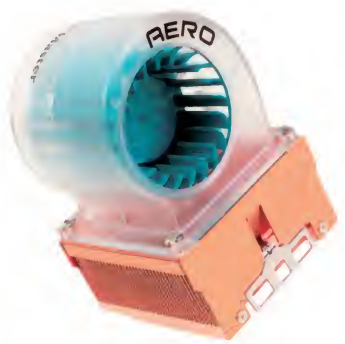
While it's got some nice touches in its feature list, as well as a very CPU friendly clip, the Volcano 11 is let down by what really counts – its ability to keep your CPU nice and cool. BR

Specifications:

Copper base; 4,800rpm 80mm fan; weight: 480 grams.
Website: Thermaltake www.thermaltake.com
Supplier: Anyware www.anyware.com.au
Phone: (02) 9879 5788
Price: $54.95

6/10

Cooler Master Aero 7 <<<



The Aero 7 is Cooler Master's latest creation, and is a very different beast to what most of us are accustomed to. The main feature of this HSF is the sideways-mounted fan. Still directing the airflow down over the heatsink base instead of out the back as you'd expect.

There's a very good reason for using this type of fan. With a standard fan mounted to a heatsink, there is always a 'dead zone' directly in the centre of the fan where the bearings are mounted. There is no airflow being pushed down onto the heatsink from this area, where airflow is actually needed the most. The fan on the Aero 7 removes this problem.

A fan speed control knob is included, allowing you to manually set the speed between 1,900rpm and 4,500rpm. While Cooler Master claims that the Aero 7 is a silent heatsink, it's actually only silent at the lowest speed, which is not fast enough to provide decent cooling.

The fan speed controller can be mounted in a spare 3.5in bay drive, instead of the standard PCI blanking plate that most other models use. The Aero 7 also has one of the best heatsink clips we've ever seen, being simple to mount without the need for a screwdriver or needle-nosed pliers.

Chernobyl was set to the standard 80W, while ambient temperature was a constant 20C throughout the test. The same SLK-800 used in the Volcano 11 review was used for comparison against the Aero 7.

At the lowest fan speed, the Aero 7 peaked out at 72C; great if you like fried chips, but crap for the sane PC user. However, when we cranked up the fan speed to maximum, it was a whole other story. It appears the sideways-mounted fan works well, as the maximum temperature was 50C, a mere 2C higher than the beastly SK-800.

As a result we've got no hesitation in recommending the Aero 7. It offers performance that is almost as good as the SLK-800's, while being slightly quieter at a much lower cost, and the convenient fan speed controller means that it's simple to manually adjust the speed of the fan to suit your usage. A masterful cooler from the Cooler Masters. BR

Specifications:

70 x 70 x 70mm; Copper-skived fin design; weight: 620 grams.
Supplier: Australia IT www.australiait.com.au
Website: Cooler Master www.coolermaster.com.hk
Phone: Australia IT (03) 9543 5855
Price: $66

HOT atomic MAXIMUM POWER COMPUTING

9.5/10

HauppaugeTV-PVR-350

Hauppauge sounds like a scary latex USB device, spawned from the evil heart of online sex-toy hell. Thanks to A-bandits it's really a company that produces the outstanding, ever-expanding WinTV range of TV tuner and capture cards. With hardware MPEG-1 and 2; FM stereo; and analog video/audio input/outputs, all the PVR-350 needs is IEEE 1394 and you'd be in dub-slut heaven!

The mettle of these cards is picture quality, especially when you output to disc or tape. Definition is very good, and regardless of motion everything is crisp without any ghosting artifacts. Warm rich colours are a lovely surprise, coupled with the clarity of contrast that leaves the whites Napisan white – not video grey.

Unfortunately, the PVR-350 comes with WinTV2000 – extremely ordinary. Tweaking functions for image and sound are abundant, but the recorder bar sits at the lowest edge of the window, and is usually out of reach unless the screen size is reduced. Also bordering on boringly basic is the time-shift function. It's the 'replace-the-VCR' factor with most cards, and the WinTV method is functionally okay – but annoying to use. Nonetheless the DVD authoring suite shows off the card's attractive encoding features.

Hardware MPEG encoding makes the difference. The high quality and ease of capturing from TV or analog devices may just make your tape-chewing monkey-in-a-box cringe from under the TV set. Running on specs that are low enough to be cost-effective and easily cooled, the PVR-350 is a capable partner for any home-theatre setup. As for the included IR remote. . . while it's aesthetically pleasing, the contraption has an attitude problem with activated windows outside of WinTV2000, and is not compatible with Winamp, PowerDVD or the like.

Using capture cards to record high quality TV and video probably means that until we can organ harvest terabyte hard disks from our pet genetically-modified pigs, the VCR or DVD recorder will dominate. Kind of a shame, because the PVR-350's impressive functionality really says something for the home theatre PC cause – regardless of its software flaws. We await the revolution. VS

Specifications:

Requires: Coaxial TV & FM radio; S-Video/composite video & audio input/output; Ulead DVD Movie Factory.
Website: New Magic www.newmagic.com.au
Supplier: New Magic www.newmagic.com.au
Phone: 02 9528 4555
Price: $529

7/10

X'S-DRIVE II VP2060

In this age of digital video, digital images, digital music and, most importantly, digital porno, having a portable hard drive can be a convenient way to transport these files. The X'S-DRIVE II VP2060 is the latest 2.5in laptop hard drive case, keeping you fully filed up.

The VP2060 doesn't ship with a 2.5in drive, which explains its reasonable price of $231. However, AusPC Market (the product's exclusive distributor) are now selling these units bundled with a variety of laptop drives, ranging from 20GB up to 40GB in size. There is a slight quirk with drives over 20GB in size – this unit requires that they be formatted using FAT32, and Windows XP automatically ensures that any drives over 20GB in size are NTFS. So you'll need to find a Win9x boot disk to format your portable drive if it's over 20GB.

Installing the drive is a breeze. Simply unscrew the base, insert the hard drive, and you're ready to rock. Once installed you can use either USB 1.1 or the substantially faster USB 2.0 connection to transfer files between your PC and the VP2060. If you're running XP or 2000 there shouldn't be any need to install drivers to get this product to work – plug it into your USB port and away you go.

As well as the ability to lug a laptop hard drive around as a portable storage device, the VP2060 also doubles as a card reader. Six different card types can be used in the slots on this device — SmartMedia, SD/MMC, Memory Stick, MS Pro, CompactFlash I/II and IBM Microdrive. The cool thing is that you can transfer files from any of these cards to the hard drive without plugging the unit into a PC. Especially appealing to digital photographers, who can use this device to upload images off full memory cards; no more dragging a laptop to each shoot. Not the quickest at this task, averaging a transfer speed of around 975kb/s, means it will take around nine minutes to suck down the contents of a 512MB memory card, but it's bearable.

Self-powered by an internal, rechargeable, Lithium-Ion battery (1.6 hour lifespan) means no lugging an external power pack around.

While this is a very niche product its convenience makes it a must have device. If only it were a little faster at transferring from a memory card to the internal hard drive, it'd be perfect. . . BR

Specifications:

Requires: 2.5in HDD; USB 2.0; LCD screen shows copy progress.
Website: X'S Drive www.xs-drive.com
Supplier: AusPC Market www.auspcmarket.com.au
Phone: AusPC Market (02) 9746 0900
Price: $231

8.5/10

MSI FX5200-TDR128

NVIDIA launches the successor to the MX series, and John Gillooly takes a peek.

While it delivered decent enough performance for your casual gamer, the GeForce4 MX was an incredible letdown for hardcore users. The lead-up to the release of the GF4 MX was full of implication, that it would deliver DirectX 8 compliance to the masses. It turned out to be little more than a warmed over and higher clocked GeForce2.

This was a crying shame, considering that the preceding GeForce2 MX created a whole new class of low-end performance 3D graphics. Those after beef on a budget bit the bullet, threw in a few more dollars and went for the quite amazing GeForce4 Ti4200, relegating the GF4 MX to the land of pensioners, Solitaire addicts and home theatre boxes.

NVIDIA learned from that particular mistake, and has adopted a philosophy of top-to-bottom DirectX 9 compliance for its GeForce FX product line. Gone is the MX name and in its place is the GeForce FX 5200. This chip is both cheap and readily available, largely because it is built on a 0.15-micron process, which helps NVIDIA avoid the rumoured problems with 0.13-micron. It also uses TSOP-packaged DDR instead of the more expensive BGA-packaged DDR-II in the GeForce FX 5800-series.

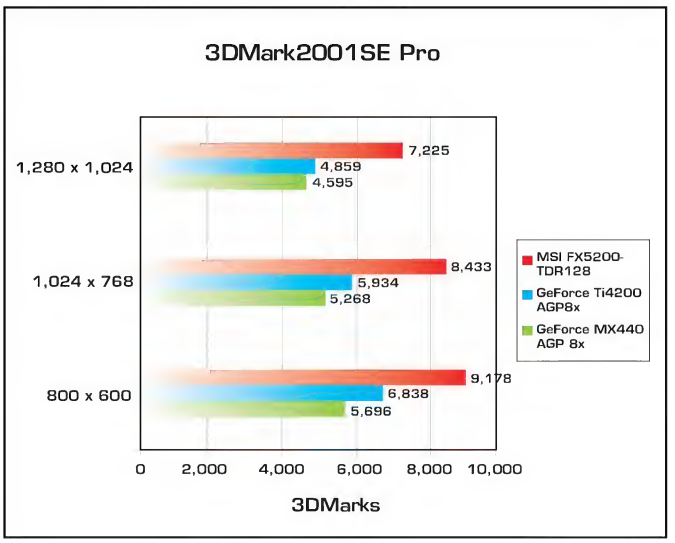
The major architectural difference between the FX 5200 and its big brothers is that it lacks NVIDIA's Intellisample antialiasing technology. While this is disappointing, such technology would be redundant on such a low-end card.

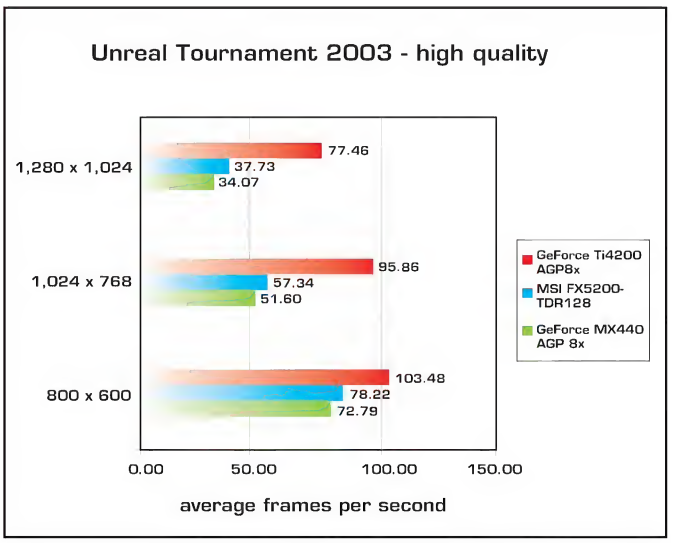
We got our hands on MSI's FX5200-TDR128, which uses 128MB of DDR-RAM running at an effective 400MHz alongside a 250MHz core. There are two other variants of the FX 5200, a higher-clocked Ultra model, and a barebones version that uses SDRAM. This card is more expensive than most of the other models now on the market as it is bundled with an IR remote and a comprehensive set of software. It is also actively cooled.

The FX5200-TDR128 was tested against the AGP 8x versions of the GeForce4 Ti4200 and GeForce4 MX 440. While we didn't expect blazing performance from the FX 5200, it should at least beat the older budget cards. We tested with 3DMark2001SE Pro and UT2003, using our Athlon 1800+ testbench.

While the FX 5200 manages to beat the GeForce4 MX 440, it falls way behind the GeForce4 Ti4200. In UT2003 this starts as a gap of 30% between the two at 800 x 600, but at 1,280 x 1,024 the Ti4200 gets double the frame rate of the FX 5200. The gap in 3DMark2001SE Pro is not as great, with the Ti4200 only 50% faster than the FX 5200 at 1,280 x 1,024.

Considering you can pick up a GeForce4 Ti4200 for about $300, the $250 price tag for the FX5200-TDR128 seems way too high. The GeForce4 Ti4200 is also DirectX 8.1 compliant,





meaning that it will cope beautifully with modern games that use pixel and vertex shaders. Even though the FX 5200 takes this a step further by supporting DirectX 9, we expect that the majority of games that support these next generation features will focus on DX 8-level hardware. Unless the rumoured next generation Detonator FX drivers magically double the performance of the 5200, we heartily recommend that you kick it retro-style and go for the GeForce4 Ti4200. JG

Specifications:

NVIDIA GeForce FX 5200 GPU; 128MB DDR-RAM; 350MHz RAMDAC; TV-out; IR remote.
Website: MSI www.msicomputer.com.au
Supplier: MSI www.msicomputer.com.au
Phone: MSI (02) 9748 0070
Price: $255

5.5/10

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Sapphire RADEON 9700 PRO AIW <<<

Just like us Homo Sapiens Sapiens are a little bit more advanced than our Homo Sapiens ancestors, the RADEON 9700 PRO All-In-Wonder (AIW) is a cut above the vanilla RADEON 9700 PRO.

To achieve this evolutionary marvel ATI has taken one of its fastest video cards and strapped on a TV tuner and its RAGE THEATER 200 chip. This mother has no problems powering a fast-paced game of Battlefield 1942, recording the latest *Simpsons* episode or helping show off the highlights of your extensive DVD collection.

In the past, the joys of the All-In-Wonder series have only been available on lower-powered video hardware (the RADEON 8500 version used the slower LE chipset), however ATI has rectified this with both the RADEON 9700 PRO AIW and a newly announced RADEON 9800 PRO-based model.

Centering around ATI's new Multimedia Centre 8.1 software, the RADEON 9700 PRO All-In-Wonder supports playback of most file types natively, and also comes with a version of RealPlayer designed to take advantage of its FULLSTREAM video smoothing technology. All of this is controlled by a RF wireless remote control, which has limited programmability.

We tested the AIW using our usual suite of 3D benchmarks, and performance was almost identical to a normal RADEON 9700 PRO. Where it shines, and where interest lies, is in the multimedia functions of the card, which all work beautifully.

The remote control takes some getting used to, and remapping some of the buttons is essential if you decide to use other media players.

Sapphire and ATI have come up with a winner in the RADEON 9700 PRO All-In-Wonder, the digital equivalent of having your potatocake and eating it too.

If you crave the ultimate in video hardware, then this card will stop those cold sweats and sleepless nights. JG

Specifications:

R300 graphics chip; TV tuner; hardware MPEG-2 decoding; RF remote control; VIVO functions.
Website: Sapphire www.sapphiretech.com
Supplier: Achieva www.achieva.com.au
Phone: Achieva (02) 9742 3288
Price: TBA

HOT atomic MAXIMUM POWER COMPUTING

9.5/10

Palsonic TFTV-151

You can't pick up an IT mag these days without every second page containing a rant about convergent products. Putting the best bits from two products into one makes sense: it brings the overall cost down due to shared components and a reduction in space usage. Unfortunately, implementations generally haven't lived up to the promise. Take the TFTV-151 for example. This is a standard 15in TFT LCD monitor with built in TV-tuner. It doesn't take a rocket scientist to realise that merging these two products is sensible.

The TV-tuner part of the equation is easily the strongest part of this hybrid. Simply plug in your aerial, hit auto tune and you'll actually feel your arse grow as you watch hours of repeated war footage. The image quality is nice and clear, with vibrant colours and a bright picture, although it suffers slightly if you're not watching from directly in front of the screen thanks to a lacklustre 120-degree viewing angle.

The wide range of inputs on this mutant TV wannabe is also welcome: D-sub, A/V, S-Video and SCART will allow you to hook up any of your consoles, videos and DVD players, but we can't help notice the lack of a DVI input. With a native resolution of 1,024 x 768, it's obvious this is not a cutting edge TFT. If it was, as well as running at higher native resolution, it might also have a 16ms pixel response time, instead of its 25ms. Due to this seemingly sluggish response time, gaming is a blurrier affair than we've come to expect from such a highly priced TFT. It must be said however that it's by no means the worst TFT around for the task of blowing things up.

So it's reasonably good as a TV, yet it's dated as a TFT. It's also very expensive at $1,700. When you consider that you could buy a much higher quality and larger TFT for around $950, as well as a high quality TV-tuner for an additional $200, it soon becomes clear that this is another of 'those' convergent products. A nice idea, and no doubt one day all monitors will have a built in TV-tuner, but for the moment it does the job worse than the separate components at a much higher cost. BR

Specifications:

XGA; 15.1in Active Matrix TFT LCD; stereo speakers.
Supplier: Palsonic www.palsonic.com.au
Website: Palsonic www.palsonic.com.au
Phone: Palsonic (02) 9313 7111
Price: $1,699

6/10

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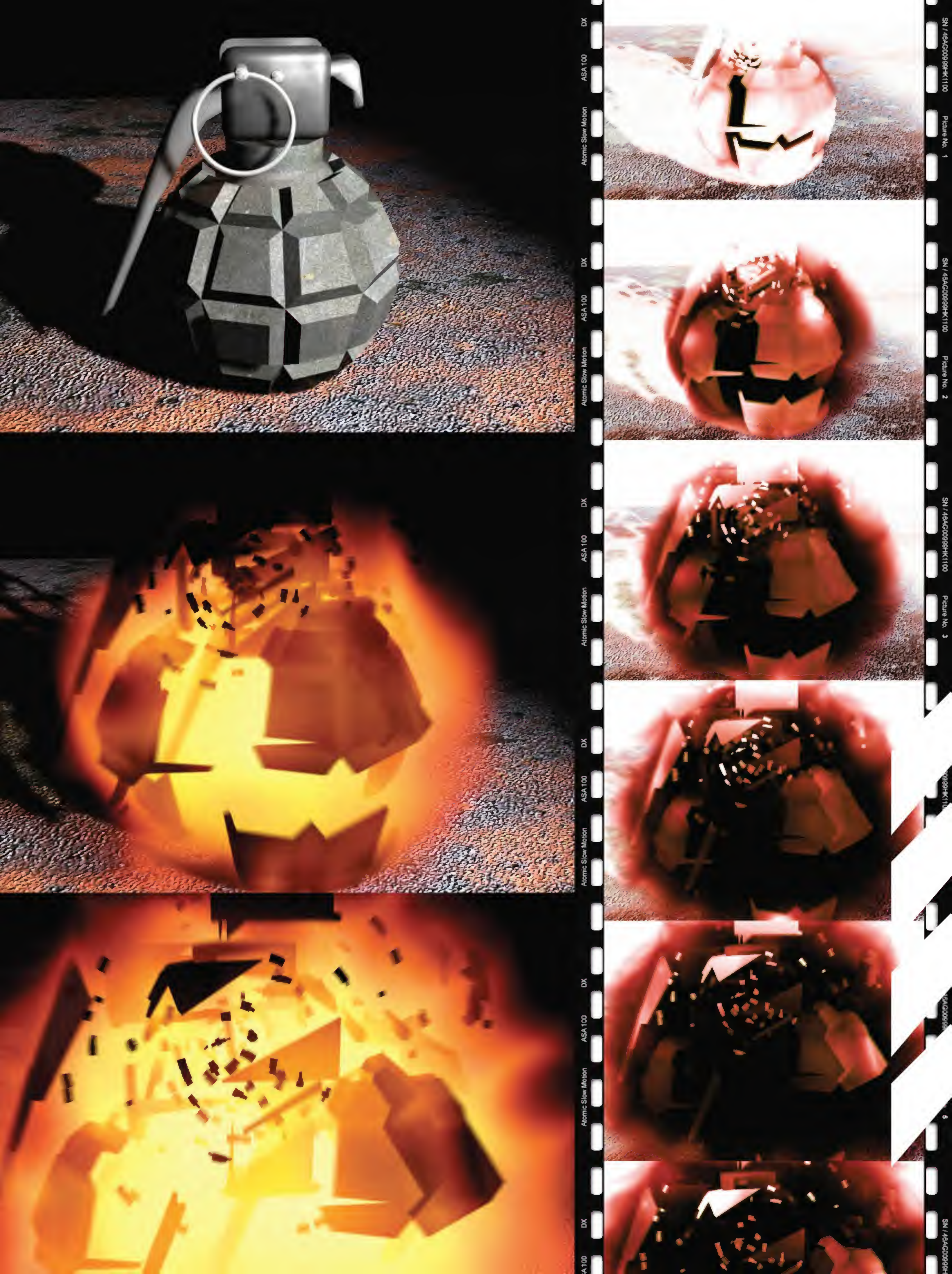
Atomic Slow Motion
ASA 100
DX
SN / 45AG0099HK1100
Picture No. 1
Picture No. 2
Picture No. 3

Desert Combat...my kind of mod

Getting Bennett Ring to stop playing this damn game so he'd write the games intro was harder than liberating Iraq.

A couple of months ago I had a rant about how Counter-Strike is getting old and that it needs to be replaced. Well, I think I've found the mod that will deliver the killing blow to CS – provided you have a ninja PC with a big phat Net pipe to run it on. It's a mod for BF1942, and goes by the name of Desert Combat. It tears Battlefield out of the 40s and into the bloody battles of the '91 Gulf War, resulting in a much faster, action-packed game than the original BF1942. And I can't stop bloody playing it. I'm not the only one, as this mod is now more popular online than BF1942 itself, and has taken over as the #1 online shooter of choice for *Atomic* staff members.

While it's still in a very early phase, 0.3 Alpha to be precise, this mod is showing more promise than even the mighty CS did at such an early stage. The development team, Trauma Studios, has replaced every vehicle from BF1942 with those present in the Gulf War, as well as a few other extras including new character classes.

Highlights are the Mil-24 Hind, AC-130 Spectre (with four controllable gun stations), the M1A1 and the TOW-equipped Humvee.

If you're a BF1942 fan, do yourself, your family and your cat a huge favour by checking out this absolute masterpiece in the making.

We caught up with the head honcho at Trauma Studios, Frank DeLise, and gave him an interrogation the lads at Guantanamo Bay would be proud of.

BR: *Do you recommend developing a mod to get a foot in the door to the game development industry? We've heard that several publishers have approached you – can you comment on this at all?*
FD: Creating a mod is a great way to get your name out there and get a feeling for the game development process. It can teach you the right ways to optimise your models, new ways to skin and animate, as well as learn from others. Desert Combat has been approached by various publishers for Desert Combat's future, as well as new projects.

BR: *How long has it taken to get the mod to the stage it's at now, and do you have any estimates on when you'll release the Beta, and then the final release?*
FD: The mod started in October 2002. We estimate version 0.4 in May, 0.5 (Beta) in June and final release in the fall.

BR: *What is the biggest hurdle you've faced when creating DC?*
FD: The biggest hurdle in DC was the learning curve of the scripting and tools. Since there was no documentation when we started and no mods to learn from, we had to learn a lot on our own. Now it is pretty easy for us to add vehicles and weapons, and we also have time to come up with new ideas.

BR: *Which is harder – developing cool new content, or balancing all the new stuff? It appears you have nailed the first but are still working on the second.*
FD: Balancing is pretty difficult but most of that is due to the fact that not everything is done yet. So we sometimes have to change the strength of weapons from build to build to accommodate new vehicles and strategies.

BR: *If there is one lesson you've learnt from creating DC, and would like to pass on to fellow mod makers, what is it?*
FD: One thing that I have made clear from the beginning, and have kept the whole way through, is professionalism. Never bash a fellow mod, be kind on the forums and don't be immature. Many modders have really ruined it by not keeping their cool and bashing other mods.

BR: *What can we look forward to in DC?*
FD: Right now I am working on DC 0.35, mostly fixing bugs and creating new maps. The weapon system in 0.35 is great, with differing accuracy for lying down, standing, running, etc. New maps such as Lost Village and Chemical Planet are superb. In 0.4 you will see some new vehicle additions such as landing craft, F-117 bombers, BMP-2 light tanks, BRDM-2 Spandrel, Cruise missiles and even some new Iraqi fighters.

Massive thanks to Frank for taking the time out to let us know a little more about this stunning mod.

Head over to www.desertcombat.com to download the install file and prepare to say goodbye to any spare time you thought you had. A full transcription of this interview can be found in the Features section of the *Atomic* Website at this address: www.atomicmpc.com.au/features.asp.

artomic

'Fire in the hole!' by Mark McPhee aka 'Ender'

The concept for the image came from a test render using a particle array to explode objects in 3dsmax. I created the grenade model from simple primitives and editable meshes.

The fire effect was achieved using 'combustion' with a few of the settings tweaked. Several renders were done at different stages of the animation and the final composition was created using Photoshop.

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Adobe

SHORT CIRCUITS

Considering the amount of material available, it's not surprising that three titles are due out based on the Vietnam War. Two of these will be on the shelves by the time you read this. Among the bunch is Line of Sight: Vietnam, Vietcong and Men of Valor: Vietnam. The last title is being developed by the folks responsible for Medal of Honor: Allied Assault, and while it won't be out until 2004, we can safely say there will be room for improvement.

While Line of Sight: Vietnam is the first to hit retail, you're best off skipping it. A cheap launch title (US$20) with arcade-like handling, it struggles to make it as a B-grade shooter.

Vietcong on the other hand is very interesting. Using Mafia's LS3D engine, the lush jungles of Vietnam are captured in considerable detail.

As for Men of Valor, we'll just have to wait and see.

Take Two's Chief Executive Jeffery Lapin has announced that Grand Theft Auto and Vice City will be ported to Xbox and GameCube consoles.

There is certainly an audience for the title on these systems, but you have to wonder if people haven't indulged in some car theft goodness already – even if it cost them $300 for the pleasure.

BUZZWORDIKAN:

Rag doll

A type of game physics where a body is modelled with soft characteristics. Using rag doll, gravity affects individual bones, allowing arms and legs to swing naturally and realistically. Collision detection with rag doll models is on a per-polygon basis, eliminating glitches such as corpses floating on stairs. Mathengine (Karma) in UT2003 is an example of rag doll.

Realtime first

Take your standard, well-oiled, ship-of-the-line issue cannon; pack the mother with potassium nitrate till a simple whiff is enough to blow off your knickknacks and cut and trim the fuse so that it's equal and mega-fine to the fourth dimension.

Stick in a thousand 1mm ball bearings and try to hit a target 10m away. Good luck.

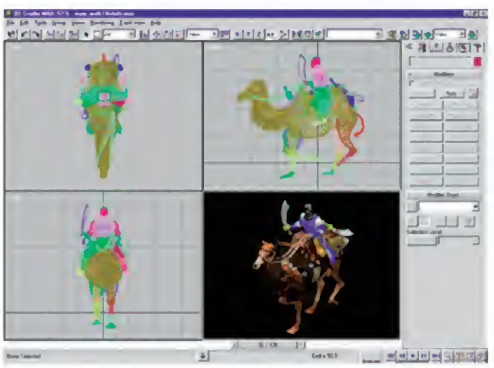
In reality, you'd be lucky if you grazed, let alone damage it or make a significant dent. Oddly enough, this quirky situation is exactly what your graphics card and system endures when it's faced with an RTS (Real Time Strategy) – thousands of tiny polygons, megabytes of unit data and too much raw power to propel it forward. Hitting the mark with this much grunt can be tricky work.

The move to 3D as a whole was great for the RTS genre. Developers no longer needed to make hundreds of 2D animations for each unit – one high-res model is sufficient. It's surprising the genre didn't make the move sooner, instead relying on voxels (Red Alert 2) to take up the slack. In fact, it's thanks to innovative titles such as Total Annihilation that we have 3D RTSes. Mind you, it wasn't a conventional 3D title, and depended more on CPU than PCI bandwidth.

Most RTS engines these days are DirectX and GPU reliant thankfully, including Warcraft III and C&C Generals, and use LOD (Level Of Detail) to get around frame rate problems, considering that most of the time you're in a 'zoomed-out' position, rendering a few hundred (processed) polygons is never a problem. LOD works by reducing the number of polygons on the fly, while avoiding graphic errors.

Early 3D accelerators had a hard time dealing with tiny polygons – in fact, Total Annihilation: Kingdoms sometimes ran better using MMX (CPU) rather than accelerated API functions. This is because most chips at the time (1999) were geared towards third and first person shooters and large models, not the small and low-poly models in RTSes.

Dark Reign 2 was one of the first 3D RTS titles to use a modern LOD system, called MRM or Multi-Resolution Mesh. Pandemic Studios licensed the technology from Intel and used it to keep poly counts to the minimum. According to a case study of the game by the studio 'The traditional, workaround solution depends on managing scene complexity with Levels of Detail (LOD). As objects recede from the foreground, programmers substitute models with less and less detail, lowering the polygon count . . . For each distance mark they [the artists] have to re-render the objects, revise the texture maps and redo the animations.' When MRM was implemented it was a huge benefit, and usually a 'cut-down' version of a high-poly model looked better than a pre-made low-poly asset.



A unit render in Age of Mythology. Up close, there's a lot of detail that you'll never see in-game.

As for polygons per model, the average RTS unit can range from 250 polys (Battle Realms) to 10,000 (Impossible Creatures), while a Quake 3 model can be anywhere from 2,000 to 40,000. However, as most RTSes will have anywhere up to 25 or 75 units on screen at one time (18,750 polys for 75), a FPS will usually see five to ten players (25,000 polys for 10) on screen at once. These values are fairly balanced, and including environments, both do about the same level of work.

Real Time Strategy games are also fairly CPU-intensive. Attached to each unit and building is unit data – health, armour, attack capabilities – it all adds up. Pile on AI and collision detection and your processor is one busy piece of Silicon.

With all this, you might be wondering why RTSes are neglected when it comes to benchmarking graphics cards and CPUs – especially as they put a great burden on both components. What it boils down to is a lack of tools and native support for benchmarking, and it's a real shame.

So, we think it'd be nice to see an RTS benchmark. . . one day.

S.T.A.L.K.E.R: Oblivion Lost

A good way to describe what you'd like to see in a game is simple: just make a list of what you *don't* want to see. For instance, we've had enough of Quake's gothic settings, repetitive textures and 16 shades of brown colour palette. We're equally jaded by Epic's depthless futuristic settings with clean and sanitised industrial complexes. After a decade of 3D advancement, current games still depict worlds that consist of flat, clean surfaces and shamelessly tiled walls. Interiors are perpendicular – walls and furniture squarely intersect floor and ceiling. Exteriors are rigid and strikingly mocked. Water intersects shore with clear-cut polygon edges. Trees are little more than glorified alpha textures, pitifully hanging off a single-textured branch; ugliness and dissatisfaction at every sight. So, leave this world, and enter the realm of S.T.A.L.K.E.R.

The 3D camps are split right now on how best to use graphics hardware. One group follows the Doom III path, whose principles are tied around unified lighting, stencil shadow and normal mapping. The other camp is more interested in making grand and realistic outdoor areas by abusing polygons and high-res textures. The X-Ray engine, used in S.T.A.L.K.E.R, follows the latter trend. Ukrainian developer GSC Gameworld built the in-house engine in roughly two years. This DX 8-level engine is a technical marvel of graphics, sound and physics. Capable of rendering up to three million polygons per frame, per-pixel lit and shadowed, X-Ray is right up there with Unreal Warfare. Where it supersedes Epic's work is the extraneous detail and art direction of the levels.

You won't see normal brick walls or flat roads, barren hills or rectangular buildings. In S.T.A.L.K.E.R, paint flakes hang off interiors and rust streaks from concrete. Roads are overgrown with weeds, pebbles and cracks. The sky is encircled by eagles and weather effects are relentlessly rendered using DX 8 post-filtering buffers. Without comparing the engines directly, S.T.A.L.K.E.R's engrossing world makes the latest UT product look like a soulless tech demo.

Set in the post-Chernobyl surroundings of Ukraine, the game's mood is dark and apocalyptic. You're given an area kilometres wide to explore where you'll find everything from mutated creatures to hidden artefacts. Borrowing a healthy dose from Deus Ex, this title is centred on free choice and RPG elements. You can trade weapons, interact with NPCs or otherwise just chill.

Scrumptious detail aside, S.T.A.L.K.E.R's implementation of ODE (Open Dynamics Engine) physics is said to be faster than commercial giants like Havoc and Karma. Along with the usual whiz-bang of inverse kinematics, particles and weather, the modelling of gravity distortions to manipulate gameplay is brilliant. The sound engine is equally impressive, implementing a partial wave-tracing algorithm for on-the-fly 3D sound calculations. Topping this package off is fuzzy logic enemy A.I with virtual sight and hearing, which ought to keep you busy if the environment doesn't.

The FPS genre has needed a face lift for a long time. Too much senseless abuse of graphics has produced games that aren't worth the CD they are stamped on.

S.T.A.L.K.E.R may not end up as the next Half-Life, but it certainly is a refreshing change. Nothing makes us happier than seeing advancement create games with better graphics – as well as better gameplay.

DEVELOPER QUOTE OF THE MONTH:

'You can make the realistic physics in games solid. It's just some work. With physics engines it's almost entirely up to how the team implements things.

'Like a renderer in a game. It just puts pixels on the screen. It's up to you to make the art look good, and the design of the game interesting enough to support the renderer.

'Same with physics. I think a lot of people underestimate the amount of effort of doing it right though. There will be wide gaps between games, just in the quality and attention paid to how they rag doll, much less other physics within the game.'
George Broussard, 3D Realms 4/3/03

In the jungle

Thanks to the power of today's systems, forest rendering is finally a reality. Yes, we're talking about Vietcong. Multiplayer in this environment will require you to unlearn all those hours you logged in Quake. Bunny hopping in jungle streams is a guaranteed method of suicide. You'll find yourself crashing through the undergrowth only to bump into an enemy. Egad.

While Vietcong has some convincing forest environments, there's still lots to drool for. Today's 3D foliage is actually 2D, manipulated from large polygons. Old games used sprites to draw plants, which is a cheap hack that makes the object always face front-on to the camera. Vietcong employs triangles wrapped with alpha textures, which by default are transparent. When the alpha texture is painted with a leaf texture, the illusion of a bunch of leaves is created. Today's trees tend to look stiff, as all the leaves on a branch reside in the polygon's plane. The alpha texture's resolution is also hideously low, resulting in leaves that, up close, are jagged in appearance. In the future, these issues will disappear, but the main point for improvement today is the physics of the actual trees.

In just about every jungle movie-set, you'll find a scene where a snapped branch or moving bush gave vital clues to the viewer. Gameplay enhancements like this would be pivotal for an engrossing forest shooter. The movement of a blade of grass can give away a sniper's position just as huge commotion warns of incoming hostiles. For this to happen, each plant would need a bone structure, and the bend deformer for each bone would need to be linked with the physics engine's collision detection. Ideally, the leaf nodes would be breakable.

The implementation isn't technically prohibitive, but will potentially require a load of work. For this generation, realtime combat in the luscious (but static) undergrowth is a darn good achievement. Perhaps the next iteration will bring us more living and dynamic forests.

Yager <<<

John Gillooly loses himself in the future and keeps his head below the clouds.

Open, rolling landscapes are where you'll be doing the do.

The Sagittarius goes all jetty on us, as opposed to its handy hover mode.

Aircraft carriers are cool. Especially when they're jam-packed with futuristic fighters.

Yager was known throughout its development as the game that has nothing whatsoever to do with famed American test pilot, Chuck Yeager. It's probably a German name meaning 'guy with anime hairdo what flies around and shoots things' or something similar. We could have found out the exact translation, but we decided to focus instead on the game, one of the best titles so far for Xbox.

Yager is a futuristic action-focused flight sim, which departs from the norm by highlighting low level ground-based combat, rather than wussy outer space combat. This gives the game a scope of missions difficult to replicate in the null void of space, and helps to create a beautifully rounded and compelling experience.

Set at the end of the 21st century, where the world is ruled by two mega-corporations, Proteus Corp. and the allied yet quite evil DST. You play Magnus Tide, a freelance pilot recovering from an incident that destroyed your craft, and your chances with love interest, and Proteus employee, Sarah. The storyline skilfully drops you into the game and slowly fleshes out a back-story without forcing it down your throat as some games tend to do. The cheesy voice acting and a variety of missions, environments, characters and locales help propel you and the story.

The vast majority of gameplay takes place within your fighter, the Sagittarius. This ship has the ability to transform between two modes: Hover and Jet. In Hover mode you have slower movement but it's much better for taking out slow craft or stationary weapons platforms. Jet mode is an interesting twist on expectations – the craft is quick and very manoeuvrable but there is no throttle control, instead moving at a constant airspeed. This initially sounds like a game-killer, but actually works beautifully. You can pick up turbo boosts scattered around the landscape and use these for temporarily faster movement, and to brake simply perform a quick switch in and out of hover mode. This takes a little bit to get your brain around, but it quickly becomes second nature.

Actual missions vary, with some standard 'go to this point and shoot all the baddies missions' to others involving sneaking through canyons, avoiding enemy drones and minefields rather than going in guns blazing, or sniping enemy base defences from a distance to soften them up for an attack.

There is also a liberal spread of bosses, occupying varied types of ships needing to be tackled with some thought, rather than just pummelled by laser fire. These battles can get infuriatingly tricky, but are not impossible and just take a little bit of perseverance.

To break up the air combat action, some missions involve manning gun turrets and defending bases. Introduced in a beautifully whimsical way. After a heavy day of fighting you relax at the local pub helping the fellas test a new cannon they have mounted on the roof. As this scenario progresses nearly every bit of furniture from the bar is catapulted into the air for target practice, including ceiling fans, chairs and even the pool table. This is both a fun distraction and some very handy practice for when you will be fighting for your life as wave after wave of enemy drones attack and try to destroy your base.

The graphics engine is the icing on Yager's cake. Simply put, this is one of the best looking games to grace the Xbox, from the reflections and cracks on your windshield to the constant rain that falls on the Bitterfield wastelands there is little to fault. Small touches are everywhere; one of the finest is the reflections of jets on the surface of lakes and rivers. These are so well done that you can instantly identify enemy jets by their silhouettes on the water.

The game is single player, which is a shame, but in no way detracts from the compelling storyline and finely-crafted missions. It's rare to see such a graphically amazing game made with such finesse and a strong focus on the gameplay experience rather than just the shininess of the water. Detractors often complain that the Xbox only has a handful of killer titles, with Yager the list has grown by one. O

HOT atomic MAXIMUM POWER COMPUTING

9.5/10

GAME DETAILS

DEVELOPER: Yager Development Team www.yager.tv
PUBLISHER: THQ www.thq.com.au
DISTRIBUTOR: THQ www.thq.com.au
PHONE: THQ (03) 9573 9207

O: Compelling gameplay; jaw dropping graphics - some of the best on Xbox; strong story.
O: No multiplayer support; and the cheesy dialogue can be annoying on occassion.

TANGO DOWN

OFFICE OF THE MEDICAL EXAMINER

Case No. 1337
Name DUCKY
Fragged at PRESIDIO
Fragged by GUNSLINGER Time In 2:47 a.m.
F14
Age 18
Race W
Sex M

Tom Clancy's RAINBOW SIX 3 RAVEN SHIELD

Nap time

If you're foolish enough to stand in the way of the highly-trained Rainbow Six 3: Raven Shield team, expect to take a permanent siesta. No other game has ever had such a lethal bunch of warriors, thanks to the most realistic AI seen in a first person shooter. Your teammates will cover your rear, breach doors and clear rooms, throw grenades on demand, and generally make your continued ability to breathe a hell of a lot easier.

Unfortunately the bad guys you'll be facing in Raven Shield have High Distinctions from the College of Terrorism. These punks will react to any sound they hear, from footsteps to gunfire, and will also notice if you've taken out any of their drinking buddies. As a result, you'll need to be quick, smart and deadly to have any chance of coming home to a confetti shower. Once you've beaten the 15 missions of the single player campaign, you should have sufficient experience to confidently take on real players in Raven Shield's comprehensive multiplayer mode. At least that's what you'll think until you get your butt handed to you on a platter by some of the most skilled players the online world has seen. The Telstra GameArena/Ubi Soft Raven Shield competition is nearing completion, but it's not too late to enter your four-man squad for a chance to win four tickets to Hong Kong to represent Australia in the Asia Pacific Raven Shield Tournament. To find out more, point your browser to http://raven-shield.games.telstra.com

Complete game guide cogs

Ubi Soft

Red Storm Entertainment

HOT atomic MAXIMUM POWER COMPUTING

MA15+ MEDIUM LEVEL ANIMATED VIOLENCE

Delta Force: Black Hawk Down <<<

Bennett Ring likes nothing more than to catch an RPG round with his chest.

'Take that! Foul vehicle.' Well, if we can't drive it, no one else will.

Maps are sprawling, thanks to the Comanche 4 engine, which does a lovely job on buildings.

One big-arse mofo cannon. A hundred fleeing civilians. How can it *not* be pure arcade?

There's no denying that the *Black Hawk Down* book and movie are brilliant examples of military story telling. If you haven't read the book yet and are even vaguely interested in modern urban warfare, grab a copy now. It's not like the author and director had to be exceptionally creative; they only needed to follow the events that unfolded in 1993 in Mogadishu. The result is one of the most frightening, awesome and furious war stories yet told, so it's not surprising there is now a game based on these brutal 24 hours.

The game sees you playing the role of both US Ranger and Delta Force operatives involved in the various missions that led to this fateful operation, as well as the actual Irene mission itself. There are around 12 different missions to complete to make it through the single player game – sadly you'll probably finish these in around five hours. Many of the missions involve you being inserted into the combat area via an assortment of military vehicles with the objective to kill somebody, escort a convoy or escape to a certain point.

Unfortunately you'll never control these vehicles, and after the delights of Battlefield 1942 this is a major disappointment. Considering the game engine BHD uses (a derivative of the Comanche 4), there's really no excuse for leaving out drivable vehicles.

You wouldn't expect a flight sim (wannabe) engine to suit a first person shooter, but BHD does an admirable job. Draw distance is phenomenal, while the sheer amount of buildings and shacks populating each level is breathtaking. Character and vehicle details are equally impressive, but interiors are very sparse and boxy. Thankfully you'll be doing most of your fighting outdoors.

Every mission you'll have at least four members backing you up. However, instead of being the one-shot, one-kill, elite soldiers you'd expect, these guys act as if they've been chewing some heavy duty khat (a Somalian tree with amphetamine-like effects). The AI for your soldiers is woeful – rarely, if ever, do they take down an enemy. By the end of the game I shot anyone who dared to even look, let alone fire at me. 'Sorry sir, but your shirt is ugly – nothing a burst of gunfire can't fix. There you go – red is *so* your colour.'

According to the manual your team mates are supposedly able to clear rooms in the same manner as real US soldiers – after flashing the room each soldier heads to a different corner. In reality they end up flashing you, before getting gunned down by the bad guys as they enter the room.

With enemies as intelligent as frontal lobotomy patients, you'll be within a couple of feet of a skinny and he still doesn't hit you. The real life soldiers were amazed at how bad the Somalians were at shooting, but there's no way they were this inept.

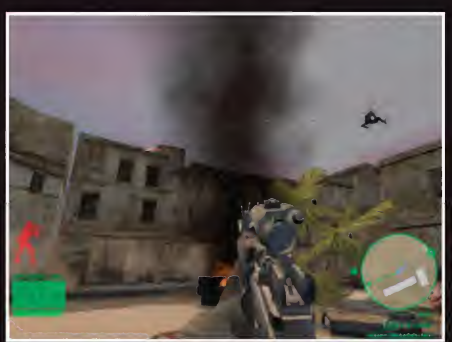
Multiplayer is a variation of capture and hold game play, with the added novelty of Black Hawks and ground vehicles. Like the single player, the vehicles aren't controllable, instead orbiting the map like bizarre cable cars with miniguns. Again, compared to games such as Desert Combat, this is fairly disappointing.

While there's a lot not to like about BHD, it makes up for these flaws with a heavy dose of atmosphere. The vast maze-like levels, packed to the brim with hostile AK-47 wielders, manage to capture the feel of the event. The radio calls of your team mates helps to impart the notion that the brown stuff has just hit the Black Hawk rotor. In summary, BHD is pure arcade bliss. The highlight of the game is easily the Irene mission, where you relive the event the book and movie are based around.

You'll have a blast completing the campaign, although it becomes a little samey after a while. You'll probably finish it in a single night, and the multiplayer isn't likely to hold lasting appeal.

This is the biggest complaint of the game; while the other flaws are easy to overlook considering how much fun you'll have, it's simply far too short to justify spending $90.

7/10



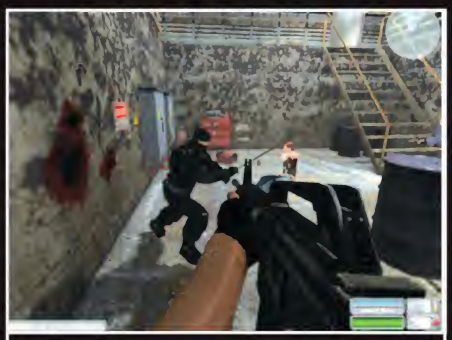
GAME DETAILS

REQUIREMENTS: 733MHz CPU; Direct3D video card with 32MB memory; 256MB system memory.
RECOMMENDED: 1.5GHz+ CPU; GeForce3 or better; 256MB memory.
DEVELOPER: Novalogic www.novalogic.com
PUBLISHER: Novalogic www.novalogic.com
DISTRIBUTOR: Electronic Arts www.eagames.com.au
PHONE: Electronic Arts 1902 261 600

O: Pure arcade action; furious firefights; captures the feel of the book and movie.
O: Shocking AI – both friendly and enemy; non-drivable vehicles; play is woefully short.

Devastation <<<

Nice establishment, but it's not exactly rocking Logan Booker.



Striking enemies with slick lead *is* satisfying, but it's better watching all that blood.

Sileoentis! Haud, hauddum. Fere condio moribundus periclitatio letum. Ha!

Look at the detail – it's *almost* cream worthy. Almost – the AI spoils it all.

Relax. All those anarchists in the outer suburbs won't be defacing in excitement, mugging in delight, or smashing windows in ecstacy. Instead they will be veraciously harassing their monitors with their shoes arguing with youthful futility. Why? Simple, Devastation can make the sane insane.

Devastation *needs* patching out of the box. The bugs are really blatant, and makes you wonder how they snuck past QA. To be fair, we decided to play with patch applied.

Coming from this, Devastation is not a bad game. It has no problems building atmosphere thanks to the microscopically refined maps. Submerging into the story isn't hard, with Flynn, the main character. Through his well voiced rhetoric, we learn that Grathius Corporation is in charge of the planet after a global catastrophe. 'Pacification squads' are the local law enforcemers and don't take 'rebel' for an answer.

While the game is heavy on the clichés – references to disloyalists, characters spitting out old diatribes on fairness and equality, etc – you *can* adjust to the story without excessive wincing.

What will make you cringe is the AI, and here's where we take a long, deep breath.

Devastation's claim to gamehood is its 'enhanced' and 'life-like' artificial intelligence. Now, while at times it shines like a sparkling, perfectly cut diamond, it's just as easily thrown to the ground and crushed under the foot of glaring stupidity. For every time an opponent will duck behind an upturned table, wrecked car or open door, they will also stand dumbfounded as you fire rounds into their skull. Your teammates will alternate between equally amazing extremes – Gus, or Eve, or one of your other averagely-modelled followers will sit on the spot, staring gaily as you desperately dodge – Van Damme-style – past bullets, rolling barrels and the occasional piece of furniture. At other moments, they'll expertly shoot combatants through walls and other obstructions.

Equipping your teammates with weapons is a game in itself, as your buddies will occasionally rid themselves of the armaments you generously provide. They disappear without a trace, be it the second you hand them over or between levels. It's painful to watch, especially after the trouble you'll sometimes go to so your guys have decent weaponry.

It all sounds nasty, yes, but Devastation does have its diamonds. Without question, this game has some of *the most* detailed and artfully worked environments in an FPS. It makes awesome use of the Unreal Warfare engine. Every conceivable detail is attended to, from the cables attached to drink machines, to the usable scientific equipment in the Grathius laboratory. Most objects are malleable and wieldable, so you can throw trashcans, chairs and milk cartons at a moments notice. However, even during the times your weapons are absent, you'll find a pistol before the need arises to resort to suburban cricket.

Later you'll scab a 'ReGen' device, a mobile respawn point basically making you immortal. The game loses appeal once it's in your grubby revolutionist hands. The need for survival evaporates like arse steam, as throwing yourself and your buddies with suicidal abandon at gun emplacements is as effective as a game reload.

Talking of killing teammates with no remorse, Devastation does have multiplayer. It's not a requirement, but for an FPS these days it is expected. Deathmatch, Team Deathmatch and CTF are available, along with an original mode called 'Territories'.

Each side is given a set of objectives, like hacking a computer or destroying the enemy's respawn device, and you receive cash for completing these tasks. You can then spend your hard-earned terrorist dollars on weapons and equipment. Other than costs, the only thing restricting your purchases is weight.

Despite the sweet goodness that lies beneath the bone thick AI, it's hard to ignore Devastation's nibbling faults. With some polish on the intelligence and character models, the game could have been a sweet, engrossing experience, and perhaps a classic.

7.5/10

GAME DETAILS

REQUIREMENTS: 700MHz CPU; 256MB RAM; 32MB T&L video card; 1GB hard disk space.
RECOMMENDED: 1GHz CPU; 64MB video card.
DEVELOPER: Digitalo www.digitalo.com
PUBLISHER: ARUSH Entertainment www.arushgames.com
DISTRIBUTOR: Manaccom www.manac.com.au
PHONE: Microsoft (02) 9870 2200

O: Awesome, detailed and interactive environments; competent single player; 2x4s.
O: AI is teeth-grindingly painful to watch; character models are average; gun eating.

Asheron's Call 2: Fallen Kings <<<

Des McNicholas wants more MMORPG. . . will Asheron's Call 2 suffice?

Like most MMORPGs, Asheron's Call 2 lets you do whatever you want. Including nothing.

A ring of stones. . . green grass. . . and a giant rock. Very prophetic.

Fighting isn't a complex proposition. You hit them, they hit you, and someone gets a level.

Despite the name and number, Asheron's Call 2: Fallen Kings is much more than a rehash of the original. The world of Dereth and its rich history remain, but just about everything else is brand new; including simplified character development, an excellent 3D engine, and a host of innovative touches that might just make Fallen Kings (and future MMORPGs) far more accessible to new players. Whether that translates into increased subscriber dollars is yet to be seen, but the overall online experience looks fairly good so far.

Fallen Kings is set several centuries after the original game. Dereth is now a wasteland after 'The Devestation'; a terrible war between Asheron, Bael'Zharon and the Virindi Imperator. Citizens from all three civilisations have been forced underground by the monsters that roam the surface, but word has just arrived that it's safe to leave the shelters at last. After creating a character from one of three races, players complete a very solid tutorial and find themselves emerging from their shelter to rebuild the world. It might be a little too simplistic for old RPG hands, but character development and the transition to the online world is more seamless than anything yet seen in a MMORPG, thanks largely to a terrific set-up process, a decent manual and stacks of on-screen support.

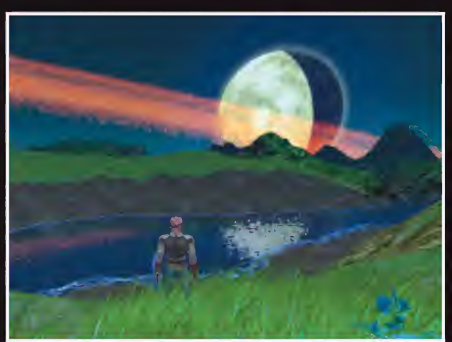
Once in the open air, players can explore at will or undertake a series of minor quests to gain experience points and advance through the game's level system. The first few quests are essentially extensions of the tutorial, aimed at familiarising players with moving through the environment and teaching the skills needed to tackle mutant creatures and stacks of dungeon-like locations. The initial story-driven campaign is a great introduction to the world of Dereth, and the developer Turbine promises new episodes and key events on a regular basis (already up to episode 5 as we write). A strong fellowship and allegiance system also helps, and a kingdom-based player versus player option adds to the value for those more interested in destruction than cooperation.

Fallen Kings has a good interface, although a few aspects are a little cumbersome and things don't always turn out the way they're supposed to. Character control is a breeze, using both first and third-person perspectives, and interacting with NPCs or items in the game world is just as simple. That said, orientation isn't made much easier by an unexplained compass and coordinate system (although you pick it up over time), and a mini-map that always jumps to the join rather than scroll along with the action. Selecting and using items is easy enough, even if switching between them causes the odd problem; and the inventory, skills and quest screens are well designed and presented. Shortcut keys and pre-defined buttons are available for just about everything, although the number of options still results in frantic clicking.

Turbine has clearly made some courageous and innovative decisions in a genre that hasn't really changed that much over the last few years. Most will be welcome to new players, but online RPG veterans will doubtless question some aspects of the design and debate already rages about whether the changes improve the long-term online experience or not. Death is a thing of the past, with demised players simply returning to their most recently established Lifestone minus a little health. It works well enough and, on balance, adds to the experience by removing some frustration and allowing fellowships to last longer than the first big battle. Trading posts and stores are nowhere to be seen, thanks to an inventory system that exchanges items for gold at will, and skills can be trained and untrained at the click of a button.

Fallen Kings is an excellent game in many ways, certainly looking much better than anything else available. Easily the most accessible RPG of recent years, most aspects of the interface are nicely done. Even so, experienced players will question the choice to simplify some aspects, and it does seem to lack a little atmosphere at times. Like all pay-as-you-go titles, the online community will decide its fate – but Asheron's Call 2: Fallen Kings is well worth a look.

8.5/10



GAME DETAILS

REQUIREMENTS: 733MHz processor; 256MB RAM; 32MB video card.
RECOMMENDED: 1.5GHz processor; 512MB RAM; 128MB video card.
DEVELOPER: Turbine Entertainment www.turbinegames.com
PUBLISHER: Microsoft www.microsoft.com/games
DISTRIBUTOR: Microsoft www.microsoft.com/games
PRICE: $99.95
PHONE: Microsoft Games (02) 9870 2200

O: Outstanding online support; terrific environments; and a fairly shallow learning curve.
O: Simplistic combat model; some questionable design decisions; and no shops for shopping!

Tao Feng: Fist of the Lotus <<<

King of the blockers, John Gillooly, meets his new nemesis.

Instead of rounds and a timer, Tao Feng relies on three health bars to pace the fight.

Tiger didn't beileve Phoniex when he said he could run up walls. Now look who's *not* flying.

The Xbox always puts on a show, and Tao Feng gives it plenty of pixels to ponder.

There are tried and true formulas for console success, reflected beautifully in the range of launch titles from Xbox. You need a good driving game, decent platform action, some wacko RPG fun and a solid fighting game. Dead or Alive 3 was the launch fighting title for Xbox and very little has happened in the genre since.

It explains why Tao Feng: Fist of the Lotus has been surrounded by so much hype. Spawned from the mind of John Tobias, co-creator of Mortal Kombat, Tao Feng promises a few significant additions to the genre while not straying too far from convention.

Fighting game plots usually make as much sense as being armed with cucumbers; they are certainly good for a chuckle but quickly become just plain absurd. Tao Feng has a certain mystery to it, with two clans going toe-to-toe to unlock the secrets of immortality. Or maybe they're battling for the right to host the next meeting of 'Freaky-Looking Fighting Game Characters Anonymous'. The story is told through scrolling text, but it's usually missed while arse-kicking.

You need to undertake a Quest mode to unlock the sole extra character. But to do that you need to battle everyone with everyone else. With six fighters per clan, this totals 72 fights before you even get near unlocking the extra character. Needless to say, the incentives given to finish the quest mode are under-whelming.

Combat in Tao Feng differs from the pack in several significant ways. The most noticeable is that the tried and true round based game is gone. There are no rounds or time limits. Each fighter has three health bars. Once the first bar runs out your fighter falls to the ground, a short scripted scene plays and then the fighter is back on their feet and the battle continues. Neither player gains any extra health when this happens – the battle continues until all three health bars of one player are gone.

This makes for fights that are much more tactical, especially when compared with the other feature of this game – limb damage. In order to negate blocking-fetishists, Tao Feng includes the potential for limb damage. Get hit on the limbs too many times and you will get a damage warning, get hit more and a bright red danger warning flashes, get hit again and you could suffer limb damage. Damaged arms deliver 50% less injury to your enemy; injure your legs and not only is damage reduced, you will also move slower. This encourages a more dynamic, aggressive fighting style, enhanced by the inclusion of 'Chi'.

As your blows connect with your opponent you generate a small amount of Chi, shown in a bar at the top of the screen. When full you can unleash a super-destructive Chi attack or use it to repair your damaged limbs.

This fairly brutal fighting style falls over with the incredibly newbie-unfriendly use of combos. Besides the all-too common two or three button combos, Tao Feng is laden with tendon-destroying combos with 10 or more presses. This of course means that the semblance of equality between seasoned 'Fengers' and newbies is nonexistent. As a newbie, be prepared to be drilled over and over again until you start nailing the combos. This is fun, but it makes for a game that involves serious dedication rather than being one that is easy to pick up and play for those long controller-swapping sessions on the couch.

Graphically, Tao Feng does not have the ooh-ah factor of Dead or Alive 3, but it does have very detailed interactive environments, rendered beautifully by the Xbox. Character animation and modelling is also outstanding, even more so by the damage modelling. As your character is pummelled and thrown about the level it develops cuts, bruises and tattered clothing. By the end of a fight, combatants will look like they've had the crap beaten out of them.

Tao Feng is a solid addition to the genre. It adds a swag of new features to spice things up, and looks good to boot. But all the looks and features in the world cannot hide that this is a brutally difficult game to get into, and ultimately lacks that special something that has you reaching for the controller to show your flatmates that you continue to rule the roost months after you first started playing it.

O

7.5/10

GAME DETAILS

DEVELOPER: Studio Gigante www.studiogigante.com
PUBLISHER: Microsoft www.microsoft.com/games
DISTRIBUTOR: Microsoft www.microsoft.com.au
PHONE: Microsoft (02) 9870 2200

O: Unique new concepts; gorgeous player models and environments; enjoyable thuggery.
O: Really difficult and can be hard to get in to; unfulfilling quest mode.

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G 8+
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Galactic Civilizations <<<

Dan Gardiner discovers he actually enjoys getting arse-whipped by E.T.

E.T? Probably not, considering this guy wants to suck out your liver with his eyeballs.

It's a cute little monkey alien. But don't let your guard down, it can swindle with the best.

The dark figure took a troubled, muffled breath. 'Soon the Rebellion will be crushed. . .'

The general consensus around the *Atomic* office is that Master of Orion 3 sucked. Gameplay aside, the user interface was so clunky that it was nearly impossible to get anything accomplished. And the fixed resolution of 800 by 600 just gave us the shits. But MOO 3 did have one positive effect: it got us hyped up to play a good 4X (eXplore, eXpand, eXploit and eXterminate) strategy game. It looks like Galactic Civilizations might just answer our prayers (and needs).

For those unfamiliar with the 4X genre, a basic game of Gal Civ requires you to create a space empire and dominate the galaxy. This is done by building starships, colonising and managing planets, researching new technologies and generally kicking the arse.

Gal Civ is a tiled-based 2D galaxy filled with star systems – the objective being to take hold of the planets orbiting these stars by any means necessary. Planets are then used to build starships, and they also contribute to researching new technologies. Your starships also inhabit this 2D map, and are used to attack enemy ships, colonise and invade worlds.

There are five major alien species also vying for galactic supremacy (including the curiously E.T.-like Torians). Each has a certain alignment that governs their demeanour and how they'll respond to you. The AI can be devilishly tricky at times because it has access to all the same gameplay features as you do. Your enemies and allies are consistently surprising and cunning.

As with most 4X games, Gal Civ can initially be a little daunting. You're confronted with a multitude of different screens and options, and it can be difficult to know where to begin.

Thankfully, learning how to play and discovering new tactics is half the fun. The learning curve isn't impassable – although we experienced a humbling amount of arse-kickage to begin with.

What sets Gal Civ apart from other 4X games is its focus on deep, empire-level strategy. There's a real sense that you're not just managing a bunch of individual colonies, and almost every aspect of the game is streamlined so you can concentrate on building and expanding your civilisation as a whole. The inclusion of random events (such as all species being forced to share their research, or finding an awesome starship) serves to shake things up so the game never becomes stagnant.

Gal Civ is so well-rounded that you can even win without physically attacking your enemies. Each major civilisation has a zone of cultural influence that expands as they grow in economic, military and social might. As your culture spreads, other civilisations will start defecting to become part of your empire.

One of Gal Civ's greatest strengths is its penchant for customisation. For example, although you're restricted to playing as humans, you can customise and change the species' abilities to give them a bonus in over a dozen different areas. This in turn drastically changes the way you play.

Diplomacy also plays a huge part in reaching your goals. While it's possible to win a game without relying on foreign relations, it's much easier to get ahead with the help of your neighbouring aliens. Diplomacy is based almost entirely on trading, and you can barter, bribe or extort using almost anything you produce including starships, technologies, cash or even entire colonies. If you have it, you can sell it.

Despite all its strengths, Gal Civ has a few flaws. There's no multiplayer, which would have been a very welcome addition and old-school 4X fans may also be annoyed that you can't customise your own ships, being limited to set types.

Ship combat has been streamlined in comparison to many 4X games. All ships have a defence and attack rating with combat typically consisting of two ships firing at each other until one is destroyed – there's little strategy involved.

4X games typically offer excellent replayability. Designed around the idea that when you provide players with sophisticated gameplay options and a healthy dollop of randomisation, every game should be unique and interesting. In this arena, Galactic Civilizations passes with flying colours. It's nice to finally find a 4X strategy game where *strategy* really counts.

8/10

GAME DETAILS

REQUIREMENTS: 600MHz CPU; 128MB RAM; 8MB video card compatible with DirectX 7.
RECOMMENDED: 1GHz CPU; 256MB RAM; 16MB video card.
DEVELOPER: Stardock www.stardock.com
PUBLISHER: Strategy First www.strategyfirst.com/en
DISTRIBUTOR: Red Ant Enterprises www.red-ant.com.au
PHONE: Red Ant Enterprises (02) 9429 3400

O: Deep, involving strategy where thinking actually helps you achieve victory. Large level of replayability.
O: No multiplayer to be found; ship-to-ship combat is a little dull and not involving.

For the serious gamer

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Delta Force Black Hawk Down images courtesy of NovaLogic

Wrenched tools

There's been a hull breach from a refrating pulse torpedo, and we're all out of nanobots. Never fear though, because Dan Rutter's donning an astro stripper and the mighty super wrench to fix it himself. Personally. Tautology at its finest, yes, but not as fine as the Logitech MX500 optical mouse, or Dan's super wrench.

IOOTM:

CRTs are damn strange.

As I understand it, you have your electron beam firing onto little triads of phosphor dots – red, blue and green ones. These dots are painted onto the inside of your screen and light up in various levels of brightness depending on how many electrons hit them.

If they're physically painted onto the screen, does that mean all CRTs have a "native resolution" similar to the way LCD monitors do? And if the dots are fixed, why doesn't the image quality degrade when you increase resolutions above this native res? And why can you have resolutions that aren't whole multiples or factors of the native resolution without the electron beam hitting the wrong triad, or dot, and making the colours come out all screwy?

This has been bugging me and my mates for a while.

Samuel Robert West

CRTs do not have a 'hard' number of pixels, like LCDs, because their phosphor dots are not arranged in a rectangular matrix. The standard arrangement of dots on a conventional shadow mask CRT is hexagonal.

ABOVE: 'Doesn't *look* sharp, doesn't it?'

The above picture looks very fuzzy, but the monitor it's from looks quite sharp. The picture's of a regular 19-pixel high Windows mouse pointer, on a 19in Samsung 955DF monitor running at 1,280 by 960. The exposure's set low to clearly show the dot colour, so it doesn't really convey the brightness of the screen. But it actually does show you how poorly the pixels map onto the phosphor dots.

While CRTs don't have a "native resolution", they do have limits; practically all CRTs can display resolutions that are too high for the number of actual phosphor dots available on the screen. When you display too high a resolution – 1,600 by 1,200 on a 17in CRT, for instance – you get a fuzzy image.

The general rule of thumb for shadow mask monitors is that you need about 1.25 dot triads (adjacent sets of one red, one green and one blue dot) per pixel.

The screen in the above picture doesn't look hideously blurry when viewed normally, because the phosphor dots are too small for the human eye to resolve. You can just see them, as a hexagonal grain pattern, if your eyesight's ok, and your nose is pretty much touching the screen. They become clear if you use a magnifying glass or jeweller's loupe, but that's not the usual monitor viewing technique.

As you can't see the individual dots, you perceive all-dots-bright as white, and all-dots-dark as black, and edges look pretty sharp. They won't at higher resolutions, but there are enough dot triads per pixel to carry it off at 1,280 by 960.

There's no distinct correlation between pixels and dots. The pixels just fall as they will, as the monitor does its best to paint however many pixels you've asked for on the phosphor dots available.

The reason why changing the resolution doesn't screw up the colour is because there isn't just one electron beam; there's one each for red, green and blue. The beams come from different spots at the back of the tube, and the shadow mask – or aperture grille, in Trinitron/Diamondtron monitors – stands between each gun and every phosphor dot that that gun is not meant to be able to illuminate. You can temporarily misalign the mask, and significantly misalign an aperture grille, by whacking the monitor; I don't recommend you do that, but if you do, you'll notice colour changes while the mask or grille vibrates, and its shadow moves around. Drop a monitor hard enough and you can permanently misalign the mask or grille, which will give you trippy colour forever.

Etch the oceans!

I have just been reading in the *April issue* of *Atomic* about etching PCBs for the Aural Decipher. Something that has been preventing me having a go at etching PCBs is what to do with the etchant after use – how to neutralise it, and whether it is then safe to simply dispose of down a drain. I'm guessing that the etchant would be a fairly strong acid (it is removing a layer of copper after all).

Nowhere I have looked seems to have any directions of what to do after etching is complete. They leave it up to you to figure out what to do with it.

Matthew Ruth

The kinds of PCB etchant used by hobbyists aren't actually acidic; they're alkaline. But they are, as you say, not good to tip down the drain. Copper is poisonous, for a start, and it goes into the solution in the course of etching the board.

You can pour all sorts of horrible acids and bases down the drain with sufficient dilution (caustic soda drain cleaner, for instance, is ghastly stuff when concentrated, but goes into the sewer by definition), but no amount of dilution makes it okay to

dump toxic metals. This doesn't mean that lots of hobbyists don't dump used etchant down the drain, mind you, but they shouldn't.

The most popular hobbyist PCB etchant is ferrous trichloride, which is cheap but dirty. Ammonium or sodium persulfate is cleaner and more elegant, but needs to be heated to work.

You can neutralise used persulfate etchant by mixing it with used PCB developer solution, but there'll still be copper in there. To make the result safe to dispose of yourself, you can mix it with cement; that locks up the copper effectively, and leaves you with the makings of a lovely rockery.

If you don't feel up to that, you should be able to unload the stuff at your local Waste Management Centre, or whatever it's called in your state or territory.

By the way, there's a good PCB making FAQ here: www.ping.be/~ping0751/thepcb.htm

CPU on a wire

Q Dear l337 *Atomic* HaxOr gUrU

I was wondering: are their any socket extensions you can plug into your CPU socket to extend it, just like an extension cord? Then you could cool your CPU outside of your case, where there is cooler air. Think of all the possibilities – you can seal your CPU off and have a direct contact water cooling set up! No more Arctic Silver!

Steven Xue

A Can't be done, I'm afraid.

The high bus speeds of modern CPUs – heck, even of very *old* CPUs – mean that if you unsoldered the socket and attached it to the motherboard with a bunch of lengths of hookup wire, you'd get horrible noise and crosstalk problems between the wires carrying signals. Shield all the wires and capacitance and inductance will eat the signal. Jacking up a socket a few millimetres would be doable, but that wouldn't achieve much; a real extension cord would be a very difficult proposition indeed.

Assuming you managed to magically solve the signal degradation problems, you'd also find you needed pretty hefty wire, because even if you boosted the supply voltage so that the CPU still got enough volts through the extra resistance of the wires, you'd burn up thin wires. A 60-watt CPU running from 1.5V is drawing a total 40 amps through its various supply wires. Even if you managed to squeeze 20AWG hookup wire into the socket, you'd still only have a current rating of about 3.3 amps per strand!

Alas, poor hard drive. . .

Q I was in the process of creating a server, and required a hard drive that was in my main PC.

My brother was playing a game at the time, and asked if I could remove the hard drive without him having to shutdown, as the drive wasn't plugged in.

This seemed logical, but about three seconds after unscrewing and removing the drive I noticed his game cease movement. I had accidentally pulled the IDE cable out of my main drive.

I shut down, plugged it back in and restarted, but nothing happened.

Is my hard drive completely dead, or is there some way of reviving it?

Should I start saving for a new drive?

Damien

A The drive's mechanical components, and the data on the platters, are all probably perfectly fine. There might be a data error if the drive was writing when its cable got yanked, but that'll be the extent of the damage.

It sounds, though, as if you've zapped the controller board. Controller boards can be replaced with one from an identical drive; this is a good use for drives of unknown provenance from eBay, as dodgy drives full of platter errors are likely to still have a perfectly happy controller board.

Replacing the board isn't very difficult – you may need a Torx screwdriver set, and you should take basic anti-static precautions, but modern drive designs don't usually even have a cable between the board and the mechanicals. You just unscrew the old board, lift it off, and reverse the procedure to attach the new one.

If you can't find an affordable drive of the exact same model (and capacity) as the one you've got, though, and you don't want to buy a new drive of the same model (or can't), then you're out of luck. You may be able to buy a bare board from the drive manufacturer, but it *won't* be cheap.

Good data recovery companies should have boards on hand for various drive models, but they'll charge through the nose, too, and probably won't want to sell you the board. They exist to put data from dead drives onto *new* drives.

And I'm not even installing anything

Q When I load Windows Messenger 5.0 a 'Problem with Shortcut' window pops up. It says 'The Windows Installer Service could not be accessed. This can occur if you are running Windows in safe mode, or if the Windows Installer is not correctly installed. Contact your support personnel for assistance'.

I'm not running Windows in safe mode. How can I fix this problem?

Jamie Van

A Try the instructions here:
http://computers.douglasthrift.net/winxpfaq/#faq1
Microsoft has information on the problem, too:
http://support.microsoft.com/default.aspx?scid=kb;en-us;Q315346
http://support.microsoft.com/default.aspx?scid=kb;EN-US;Q315353

Who goes there?

Q What is the difference between a Palomino Athlon XP and a Thoroughbred? And how do I find out which one I have?

Mark Williams

A The Palomino core was the original Athlon XP (and mobile Athlon 4); the Thoroughbred is the same thing with a die shrink, using 0.13-micron manufacturing process instead of the Palomino's 0.18-micron process. There are no new features in the Thoroughbred; no more transistors, no more cache, no nothing. It's just smaller.

The smaller manufacturing process has more speed headroom, though. It also reduces the CPU's operating voltage requirements for a given speed. This can considerably reduce the power the CPU consumes, and the heat it outputs.

To positively ID your CPU, you can remove the CPU cooler and look at the chip. Thoroughbreds have a smaller and more rectangular core than Palominos; the Palomino core is square.

There's a good ID guide here:
www.overclockers.com/tips00173

Phantom wallpaper

Q When I boot into Win2K, and just before the desktop loads, I see my old desktop wallpaper. It is then replaced by the new wallpaper when the OS is fully loaded. Same thing happens when I shut down – just before the PC turns off I see the old wallpaper. Lastly, when I go to Task Manager, same thing, my new wallpaper is replaced with the old.

I've changed my wallpaper a few times to see what happens and it's still happening. Why?

This has never happened until recently and it doesn't happen on any of my other PCs.

Combat Monkey

A I'm guessing that you have Active Desktop turned on, and it's overlaying your previous non-Active Desktop wallpaper with its own. The old wallpaper is probably taking up memory, but I think it ought to be paged out harmlessly into the swap file shortly after startup, and so should have no real impact on system performance.

If you turn Active Desktop off (go to Folder Options in Control Panel, go to the General tab, and under Active Desktop, click 'Use Windows classic desktop') then turn off your wallpaper in Display Properties, you ought to be able to turn Active Desktop back on and not have the problem any more.

BELOW: An extremely active desktop. The addition of an F-14 and crazy plumes of spray make for the best Windows activation ever.

ABOVE: Removing the CPU HSF is a great way to make a hot box.

Smaller = cooler?

Q Lately I've been reading a lot on case cooling, and most people seem to think that a bigger case is a better case. I have an argument. Smaller cases have smaller volumes, so wouldn't temperature be easier to pump out, because the casing has less volume (less air to transfer).

The theory I'm suggesting is: Smaller cases have less air to transfer, therefore creating a stronger 'vacuum' effect to transfer heat, whereas in a big casing, heat is not efficiently sucked out by exhaust fans and lingers to increase ambient temperature.

Ying

A It doesn't quite work that way. The case size actually doesn't matter, all other things being equal. All things aren't going to be equal, though; in the real world, the big case is likely to score better, because it has better ventilation.

What we have here is a heat source (the stuff inside the case) and an air-mover (the fan or fans) and some air. If the heat source is the same (pumping out, let's say, a hundred watts, and trying to get it into the air through some set thermal resistance) and the air movement rate is the same (moving, let's say, one cubic metre of air per minute through the case) then, in physics-experiment-land where everything else is exactly the same, the same amount of heat will make it into the air inside the case, and be blown out the back by the fans, no matter what size the case is. Size of a matchbox; size of a blimp – there's no difference after the startup phase, where the air inside the case warms up to equilibrium. That startup phase will be longer for bigger cases, and very long for something the size of a blimp that's only having one cubic metre of air blown through it per minute, but for PC cases it makes no difference to anything.

Put the same hardware in a smaller case, and you'll have proportionally more of the case's volume taken up by cards and cables and such, all of which obstruct air flow. Smaller cases also, generally, have smaller and fewer fans and vents. Even if the fan power's the same, the holes the air's getting in and out through are likely to be smaller.

For this reason, bigger cases are likely to be better cooled, even if the fan power's the same.

We're back under the bonnet this month with Simon Peppercorn. He's had to wrench himself free of Windows's mechanical mess after some punk threw a spanner into the works. So, screw your head on and top up on some expert knowledge. If you have some overflowing (out your ears, perhaps), send it in to phr33xtw33x@atomicmpc.com.au.

TweakOring your Windows security – part 2

Some well-known viruses owe their destructive success to certain weaknesses in Visual Basic scripting. By default, Windows automatically executes a .VBS file (Visual Basic Script), when it is delivered as an attachment to an email, using a scripting host.

If you don't create script files in VB, then there is no good reason to have the Windows scripting host installed. So kill it.

To perform this execution in Windows 2000, go into My Computer, then Tools | Folder Options | File Types. Find 'VBScript Script File' in the list and nuke the bugger.

The danger here is that some applications may rely on the Windows Scripting Host to function correctly, although I can't think of any. If you do experience scripting error messages, you will need to recreate the association.

Smelly patches

You may be the type that doesn't bother getting the latest updates for your operating system. As suspicious as some may be about Microsoft Update, it may pay to have a closer look.

Glaring security holes do exist in all flavours of Windows. Some are rarely likely to affect you. Others can be dangerous if left unchecked. For example, Windows XP's 'Add Network Place' function, found in the My Network Places folder can be one such security hole. This wizard allows you to create shortcuts to network locations, such as shares on a LAN or a Website address. (This is different to a Desktop shortcut, which simply specifies a path to a particular network location or Website.)

The Add Network Place wizard allows your network client to use the Windows Redirector to access files, irrespective of the actual protocol being used. Even the 'NET USE' command, makes use of the Windows Redirector.

Under Windows XP, the Windows Redirector uses an unchecked buffer for receiving parameter information. Someone with naughty intentions could exploit that buffer to deliver customised code, which could compromise your security, and allow full, unrestricted access to your system.

Microsoft claims that the attacker would have to actually log on to that system first to be able to launch the Windows Redirector. Yes, the Windows Redirector can only be executed locally. What happens at LANs, however, when people start trawling through the Network Neighbourhood/Places, browsing the freeware(z) collections of others? The attacker just needs to wait for you to come to him. Scared yet? No?

Unchecked buffer vulnerabilities also exist in the following software (along with many others):

- Microsoft Locater Service
- Network Share Service
- Windows Shell in XP
- PPTP (Point to Point Tunnelling Protocol) of Windows 2000 and XP
- Windows Shell in XP
- Windows Help in Windows 98 and higher
- native file decompression functions in 98 (with Plus pack), ME & XP
- Universal Plug and Play Service
- Windows 2000 IIS (Internet Information Service)
- Windows 2000 event viewer
- Windows Media Player
- MSN Chat

With more script kiddies testing out their l33t haxOrship skillz than ever before, you may as well be handing out slips of paper with your administrator password, written in crayon.

Keep an eye on the Windows Update pages, and think seriously if any of the security patches are relevant to you. It has been known for some patches to cause more harm than good, however, so don't just blindly install every one, and certainly don't set

TAKE A DUMP. . .

Often, when Windows crashes, it creates a memory dump. This file can be useful in terms of troubleshooting what the fruck caused your system to crap itself, as long as you know how to read it.

I don't, and I doubt many of you do either. But this file can also pose a security risk as it can contain information such as usernames, file locations, and possibly even passwords.

Dr Watson is a Windows debugger utility that you can use to view the dump file ('drwtsn32', from the Run dialog box). It shows you the program which caused the error, the piece of code that caused the crash, a bunch of general system information, who was logged in at the time and so on.

However, viewing the file in Word revealed (apart from many thousands of pages of garbage) information such as other usernames that have logged in, the full path to many installed applications, URLs to Websites visited, full network paths to network resources and in some cases, large portions of text from personal documents. That doesn't mean that everyone will find that stuff in their own dump files. It depends what your system was doing at the time it crashed.

When you have finished looking at it, delete it. Also, feel free to disable its creation via the Dr Watson program. You'll save yourself about 128-256MB of drive space, but this really depends on the amount of RAM you have in you computer.

Brush strokes

All it takes is one misplaced stroke to cause an accident. So, let Ron Prouse guide that artsy hand so you can get your case painting right. . . first time round.

There is one thing that that is as sure as death and taxes. . . a good case mod will always evolve slowly over time. A project might start out with a certain objective in mind, but somehow it will always morph into something that looks different to the original concept. This phenomenon is known as 'dynamic art'!

The other, unfortunate truism is that, regardless how much care is taken, the modding process will invariably inflict 'scars' – scratches, dents and the like – on the original case finish. By the time you have managed to sort out fan-holes, windows and interior mods, the end result often looks like it has been dragged over a barbed-wire fence.

If your case is brushed aluminium there is very little that you can do, however if your pride and joy has a painted or powder-coated finish then salvation is relatively simple – a fresh coat of shiny new paint! Regardless of whether you're artistic ability rivals Salvador Dali, or if you have trouble colouring between the lines, the first step to perfection is getting a smooth, blemish-free base-coat to stick to your battered old case.

One thing that cannot be stressed enough is that the final outcome depends mainly on the amount of effort that you are prepared to put in to the initial preparation.

Paint will not hide imperfections – it actually does a terrific job of emphasising them.

INGREDIENTS:

There are a myriad of optional products that will either make the job easier or ensure a better finish, but the essential requirements are as follows:

- Sandpaper – preferably 'Wet'n'Dry' for longer life. Depending on the depth of any chips and scratches you will need to start at #400 grit and get progressively finer grades up to #1,200 grit. $1.20 / Sheet
- Wax and grease remover – to remove any Silicon, etc, that paint won't stick to. $8 / 500mL
- Sanding primer – otherwise referred to as spray putty. This is a thick coat that is designed to 'fill up' any surface imperfections and sanded right back. $14 / 3.75mL
- Sanding block – usually made from cork. Especially important on large flat surfaces to give the sandpaper an even contact 'patch'. $2.50
- Undercoat – or primer. The final preparation step, it will give the top coat an optimum surface to adhere to, so your paint stays in place. $12.00 / can
- Paint – not much to explain here; top coats and clear. Price dependant on type used.
- Masking tape, newspaper and hairdryer. $8.00 / roll
- Patience. Cheap if you can agree to it.

As mentioned, if you want a really professional finish then the initial preparation is by far the most important part of the project. That means totally stripping out the case of all your hardware and dismantling it. In my case, this involved drilling out the rivets with a 1/8 drill-bit and removing the top of the case. By reducing the case to components the whole process is made simpler and, if something does go wrong, then only one section has to be redone.

Once the case is down to its bare bones, the real preparation starts. The first step is to consider if there are any additional mods you want to do, or if any existing mods need to be redone, before the paint is applied. Once any extra pre-work has been taken care of, it's time to sand back the existing paintwork so that the primer has a good surface to stick to. An idea worth mentioning here is to start by using a file to smooth off any sharp edges that might tear the sandpaper or rip off a finger.

Begin with medium-coarse (#400 grit) 'Wet'n'Dry' sandpaper, and pay special attention to any areas that are chipped or scratched. The idea of using 'Wet'n'Dry' paper is that you use water to lubricate the cutting surface so that it doesn't block up, which also extends its life. Where possible, use a sanding block so that the sandpaper is in contact over a larger surface area, as this will 'feather out' the edges of the scratches, making them blend in better. As the surface becomes smoother, progressively work down from #400 grit to #1,000 grit, until it's as smooth as a baboon's arse. If you aren't sure of that analogy (and if you are, my God!), just make it really, really smooth.

The final step here is to thoroughly wipe the surface with a wax and grease remover, and let it air-dry. The solvent will displace any water, and remove any surface impurities, such as Silicon substances that stop paint from sticking to the case. If you skip this step there is a fair chance that the primer-coat will end up flawed, and probably scratch off rather easily.

Once the remover has dried, give it another wipe with a clean, lint-free cloth to remove any dust and grit. If you're only painting some of the case, it is time to mask off the parts that you don't want painted with, you guessed it, masking tape. Use a good quality tape, as cheaper brands will often let paint 'bleed in' along the edges. Remember that the tape will need to be replaced every time you wet-sand or wipe over with the wax remover.

If there are areas that still have visible 'damage', then the next step is to use a 'spray putty' to act as a surface filler. The idea is to give the surface a light, even coat of spray putty, which will fill in any fine imperfections, and once it has dried properly block-sand the surface back with #1,000 grit until only the scratches have the filler covering them in. In other words, you will end up removing 98 percent of the putty that you just applied! This step might seem a waste of time and effort, but if you really want a 'perfect finish' then it really is worth doing.

Once done, clean the surface off with wax remover (you should be doing this between each step from now on) and a clean cloth, and then give the surface a light coat of multi-purpose undercoat, or primer. There is an old painters trick that's worth sharing at this point – warm up the part that is to be painted with a hairdryer, just so that the surface is slightly hotter than skin temperature – about 40°C. This will help to get an even cover onto the surface while reducing the incidence of runs or 'orange-peel'. A word of warning though, if the temperature is too hot the paint will dry prematurely, resulting in a powdery finish that isn't very durable and affects the bond between the primer and the top layers. An expression that is commonly heard is 'key coat', where the word 'key' actually refers to the grip that it provides for the colour coat to bond to. Sanding back between coats also gives an enhanced grip for the following coat to stick to, as it breaks up the smoothness of the surface, and also allows the paint to penetrate better.

Once dry, the look of the surface after the primer coat is your first real indication as to how the final coats will look. If you can still see surface imperfections, lumps and bumps then head back to step one! The finish should be smooth and even, without any build-up of thickness on the edges or contact surfaces.

Any rough patches of over-spray should be removed with #1,000 grit sandpaper, and then the entire surface sanded over lightly in preparation for the colour coat.

The type of paint used for the final coats will have some

bearing on just how tough the final finish will be. The two main types of paint that are available in spray cans are enamel and acrylic (or lacquer). Enamel finishes are more durable, but they take much longer to dry. They are 'glossier' by nature, and rarely need any further polishing. The more common choice is acrylic, which is the finish that is used in automotive applications.

The result 'off of the gun' will often be slightly 'satin', and to get a real mirror shine requires a top-coat of high gloss clear. That is the process we will use.

As an aside, if you have a few spare dollars, a professional spray painter will usually only charge about

$50 to 'spray and bake' the final coats on something the size of a computer case, especially if the colour is something that they are already using on a bigger job. The 'baking' process will harden the paint surface considerably, and give a much more durable finish than air-drying will. If you have a bit of time to spare, and you aren't too fussy about the exact shade of colour you're looking for, then this might be worth considering.

So, it's down to the last two coats of paint, the colour and the clear coat. The colour coat should be applied as quickly as possible, with the 'overlap' area between the parallel spray strokes remaining wet. If the overlap area dries out too much, the effect is a series of blotchy lines across the surface, and the result ends up looking a bit like a Zebra!

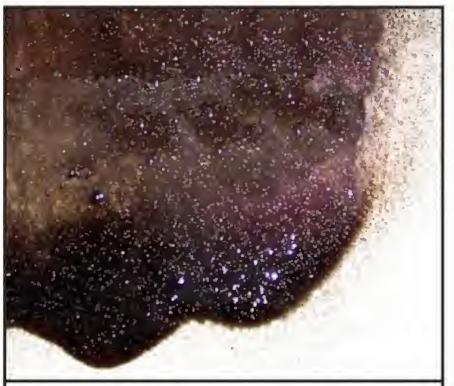
Common problems of the painter

Sissing (fisheyes)

A problem every painter faces with dismay. . . a small 'bottomless pit' that won't fill with paint. It's caused by Silicon, grease or wax on the underlying surface. The best solution is to avoid it by using a wax and grease remover. Once it has happened though the only remedy is to treat it like scratch.

Peeling

This is an extreme picture of a common problem. Peeling can be caused by using incompatible types of paints; painting over a damp surface and painting when it is too cold (<10°C), but normally it's failure to sand over the previous coat of paint, as it will not stick to a smooth, hard surface.



Build up and runs

The usual response to a paint-run is to try and cover it up with more paint – which is like throwing petrol on a fire. The only answer to the problem is the obvious; wait until it is thoroughly dry, sand out the excess paint and re-coat the panel. So resist the temptation to make things worse.

Orange peel

Sometimes this is a desired texture – especially on large area's such as car panels – but if you are trying for that 'mirror shine' it is the last thing you want. It's usually a sign of too much paint applied per coat, or drying unevenly. The only answer is to let it thoroughly dry and sand it down to a smooth finish again.

Blemishes

Blemishes usually appear when the colour coat has been applied unevenly. Almost like it had been 'sanded through' to the undercoat, or a light colour was applied over a darker base coat. If the surface itself is smooth then another coat can be applied over the top after a light sand with #1,200 grit 'Wet'n'Dry'.

Scratches

The best way to deal with scratches is to sand them out over a large area, to 'feather' the edges.The best method to cover it is to use an automotive body filler (bog) over the immediate area, wet-sand it back lightly using #1,200 grit, and then re-paint the whole panel. Or just leave it.

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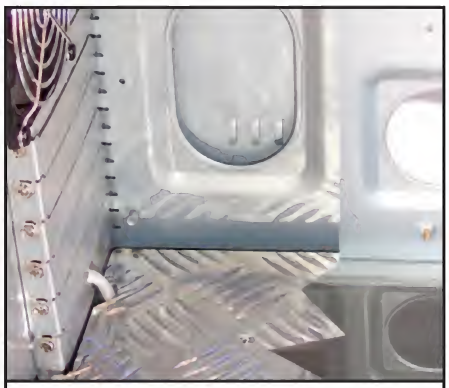
Overview of extra moddy bits

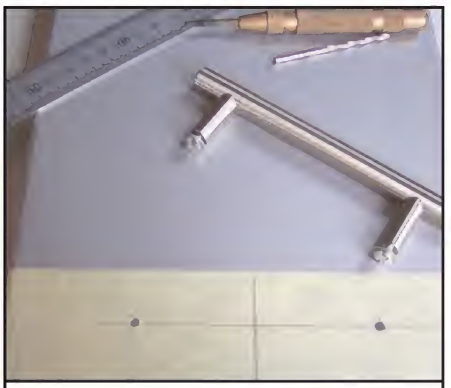


The starting point

If you are making the effort to re-paint your case then it makes sense to tidy all of those 'other' mods that have been on the drawing board first. This project was started from scratch so it included fitting castor wheels, top handles, 92mm and 120mm blowhole, a checker-plate floor and a bezel mod.

Fitting castor wheels

This is a 'no-brainer' if you have a drill and a rivet-gun. Try and avoid having the wheels protrude out too far, where they will be in the way. Position the base and mark the mounting points, and make sure the rivet 'tails' won't obstruct the sides. Then just drill and and rivet them in place.

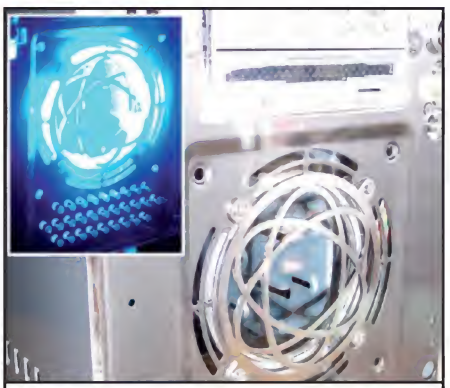


Case handles

Another simple but necessary mod if you are a serious LAN traveller. Handles should be mounted close to the edges as this is the strongest point of the case. For best results, place the large washers on the inside of the case, so that the screws wont pull through and any 'stress' is spread out.

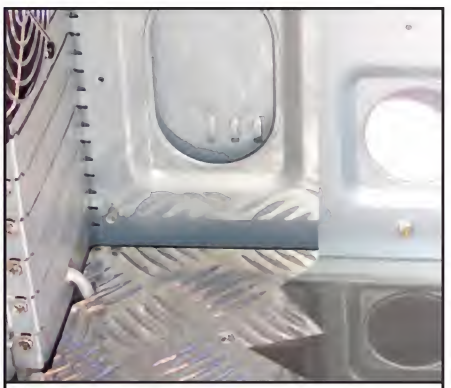
Grilling

120mm fans on 5V are great when it comes to moving air quietly, but decorative grills like this don't offer much protection from 'fan jam'. Aluminium mesh sandwiched between the fan-body and the inside of the case not only looks great, it has little negative effect on airflow.



Bezel mod

The CF2029 case (from AusPC) has a painted steel plate behind the acrylic bezel. Removing this plate exposes a 'skeletal' front framework that looks great behind the 10mm thick clear bezel. Adding a decorative grill and fan cathode gives this case a unique 'semi-Perspex' look.

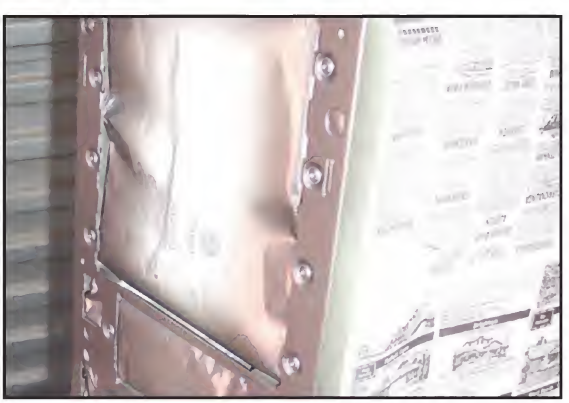


Checker-plate floor

False floors are a great way to conceal wiring. Fitting a floor is a two-step process. First, fabricate a 'spacer plate'. Drill holes through the plate and the case-floor, and screw them together from underneath using fan screws. Then, cut and file the edges of the checker-plate and stick it in.

Avoid going back over areas, as this will result in overspray around the edges of the pattern – if you need to apply a second coat to get a good finish, then you should re-coat the whole panel after the first coat has dried. Once the colour coat has dried properly, gently wet-sand the surface with #1,200 grit, making sure not to rub through the colour. A good idea is to take two sheets of sandpaper and briskly rub them together first – to dull them down so they are less aggressive.

When the surface has air-dried, wipe it over and make sure that there isn't any dust or lint that will be 'trapped' in the final clear coat. Follow the same process with the clear as you did with the colour coat and allow it to dry for at least six hours, and reassemble the case. To get an even better shine, wait for around a week and polish the case with automotive wax. Voila, a show case.



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If there is one point worth reiterating, it's the final painting step – the clear coat. As unnatural as it may seem to sand down the final colour coat to apply clear, this really will make the finished case look much better. In the picture, the bottom half of the circle is the final coat, the top right quadrant has been wet-sanded, and the top left has been clear-coated. The extra gloss and 'depth' is obvious.

Of all of the mods that can be performed to a PC case, the 'banishment of beige' in favour of a really funky colour-scheme is the one that has the most obvious visual impact. It will make your PC totally unique.

This tutorial is really just the starting point for your own imagination – a guide to creating a smooth, blemish-free canvas that you can apply your own style to. With a little creative flair you can easily create a personal 'masterpiece' that will look different to every other case out there. For example, using specialist paints such as the UV-reactive products available from PC Case Gear will make the inside of your case glow insanely with the right lighting.

From here, the tutorial steps can be followed to add contrasting colours, stripes, murals or even flames – just don't forget to leave some room for the mandatory *Atomic* logo. *Every* case mod has to have one.

SUPPLIERS:

As usual, many thanks go out to the suppliers who donated the products used in this tutorial, namely:

AusPC Market www.auspcmarket.com.au **(02) 9746 0900 supplied the CF2029 Midi tower ATX case.**
Really have to mention that this case is an absolute bargain and a great buy at $132.
It's a good looking and solid unit, with features including front AV ports and a 350W PSU, not to mention great build and design. Buy one today!

PC Case Gear www.pccasegear.com **(03) 9568 0932 supplied the whisper-quiet Panaflo fans and laser-cut grills.**

Operation Freeness

50 x Dead or Alive Beach Volleyball calendars

Can't discriminate between pink and pixels? Then the Internet is just what you need. Mind you, it's fairly annoying these days when every second pop-up *doesn't* have a scantily-clad female. Save yourself the trouble of closing these wickedly tasteful windows, and win yourself one of the 50 Dead or Alive calendars we have at *Atomic* HQ.

Thanks to Microsoft for these perfect paper pages of pixelated princesses. Can you swallow that?

Q: Which German meteorologist is considered to be the father of continental drift?

6 x RoboTech Collector's Edition pack

Every so often, we need to choose between food and hardware. It's not a hard choice really, considering toenails taste just fine when boiled in salt water. But if you're having trouble stomaching that, maybe you need to pick yourself up a RoboTech Collector's Edition pack. The six we have don't come with any condiments, but we're sure you'll be happy with the included game, which can be for PS2, Xbox or GameCube, depending on your system. Tell us in your entry which platform you'd prefer if you win. Cheers to Kate at TDK for these great bits of kit.

Q: Who coined the term 'robot'?

Thermaltake Aquarius II water cooling kit

Trickling of water; the rapture of rain. Liquids and fluids are deliciously lithe; their chemical bonds strong, yet not so strong, and delicate enough that their supple and spiritual sounds cleanse the soul.Do we care about any of that hippy mumbo jumbo? Not really, and if you do, you'd probably recycle the freshly Thermaltake Aquarius II water cooling kit we're giving away. That's 249 bucks of pumps from Anyware (www.anyware.com) – they're here for us to give. Yeah.

Q: Who fired the first laser?

Thermaltake SubZero4G Peltier cooling kit

H_2O insufficiently classy? Gets on your nerves like ice down your spine? Well, you can let that slimy spatter saturate away and pick yourself up a $254 Thermaltake SubZero4G Peltier cooling kit from PC Case Gear (www.pccasegear.com.au). It's themodynamical madness, concocted by an equally insano scientist, that'll have your mother screaming in delight. So break the laws and kick entropy in its equally equal butt cheeks. We meant mother*board* back there. Sorry.

Q: Who in the Manhatten Project calculated detonating a nuclear bomb would ignite the atmosphere?

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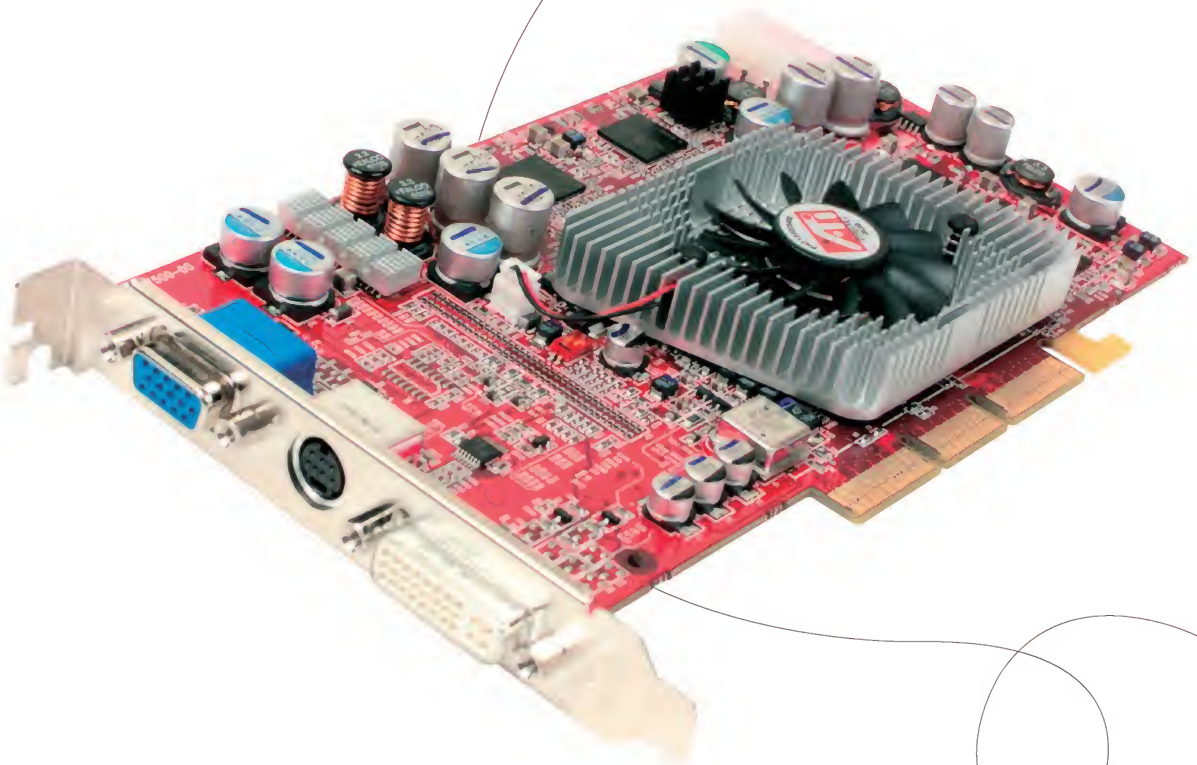
Atomic 27 winners: Monsoon Speakers Q. What is the nominal threshold of pain for the human ear? A. 120dB — 130dB. E Thornton, Salisbury QLD. Hercules DV Action Pro Q. Who were the parents of the three Harpies: Aello, Celaeno and Ocypete? A. Thaumas and Electra. A Giannopoulos, East Brunswick VIC. MSI K7NG2 Q: What is a Braxton-Hicks contraction? A. False contraction during pregnancy. S Coulson, Stafford Heights QLD.

Sub-Light

Arguably the best two pages in the mag. Right here. Why? Because you can win some specially stuff. Even better though, these are the only pages in the mag where you can subscribe. Weird but true. So don't turn the page until you're ready.

9700 + 100 = 9800?



It doesn't matter who has the biggest, or who is fasterer. And besterest. And graphicalist. Yes, we should stop making up words, but we can't not. ATI's RADEON 9800 PRO has us all tongue-tied and wide-eyed, and it'll blaze away your brain if you win it. Thanks to ATI's official Taiwanese agent, AMI Technology, for this rad $700 RADEON. All you need do is subscribe or renew this month. Absolutely golden. Did we just say rad?

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After weeks of deep examination and extensive testing, we're certain Ben's been replaced with cardboard cut-out. The insane folk responsible are still being chased down by ASIO-trained combat lions, but luckily, we found the old buckaroo hiding under his desk.

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Atomic 27 winner (Vapochill PE case): R Li, Yowie Bay NSW

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CI/A29

Chess beating

The chess world is in an uproar. In a recent match between a computer and the world's highest ranked human chess player, Gary Kasparov, the Russian abandoned a winning strategy to instead settle for a draw.

It was Kasparov's first public match against a computer since his humiliating defeat by Deep Blue in 1997. Back then, IBM's big blue box mopped the floor with Kasparov, proving to the world that, yes, school chess clubs were definitely a waste of time. Chess nerds throughout the world were put on notice: no longer were they kings of the intellectual roost.

This latest human vs machine battle tried to prove all that was just a fluke. The software –imaginatively called Deep Junior – went into battle with Kasparov in January, managing to lose once, draw once, and win once. In the nail-biting decider, Kasparov looked set to win. Then he panicked and opted to play the safe card, resulting in a draw. He was booed offstage in a hail of pen protectors and Visine bottles (some half-full).

Scenes like this rarely happen at chess tournaments, mainly because the attendees are either asleep or daydreaming about how *Star Trek* holodecks work. For a grand master to get booed is about as likely as the Pope using condoms –it just never happens. So why all the fuss?

There seems to be three immediate reactions bubbling to the surface here. First, there's a need for chess boffins to know that their hero is infallible. Go to Russia and you will see posters of Kasparov on street corners, in music stores, or as the centrefold of the Russian equivalent of *TV Week*, *Televisionnaya Nedelya*. More popular than Levi jeans or American dollars, Kasparov is the pin-up boy for huge numbers of Russian nerds. Second only to Dana Scully.

Next, there's the fear that computers are getting too smart for their own good. It's comforting to know that humans can still outwit machines, but when one of us is beaten, it's cause for concern.

How long until the AI in these chess programs finds it all a little dull, and begins playing with the power grid? Imagine this: it's Deep Junior's turn and a voice rings out: 'I'm sorry, Gary. I'm afraid I can't do that.' There'd be a few broken specs and calculators in that stampede, oh yes. . .

Finally, humans hate the idea that something inorganic can appear cooler than them, and still win. At these tournaments, Kasparov drips sweat, mumbles, eats messily and makes all sorts of odours. The computer just hums quietly, flashing a few lights once in a while to show it hasn't fallen asleep from boredom. Sort of like a big metal Fonz from *Happy Days*, sans bike and jacket. All very suave and calm. Kasparov in comparison looks about as smooth as John Howard at a union meeting.

Importantly, for the non-chess players of the world, this will filter down into the next generation of computer games. Not just more smarts to outwit, outplay and outlast our own avatars, but a smugness that's going to really try our patience. Here's a scene from Sim City 5000:

You: I'll just build some nice dirty industry here, to make some quick cash.

Sim citizen: Hey, what the hell do you think you are doing?

You: Making money to feed your fat head. Go back to walking in little circles.

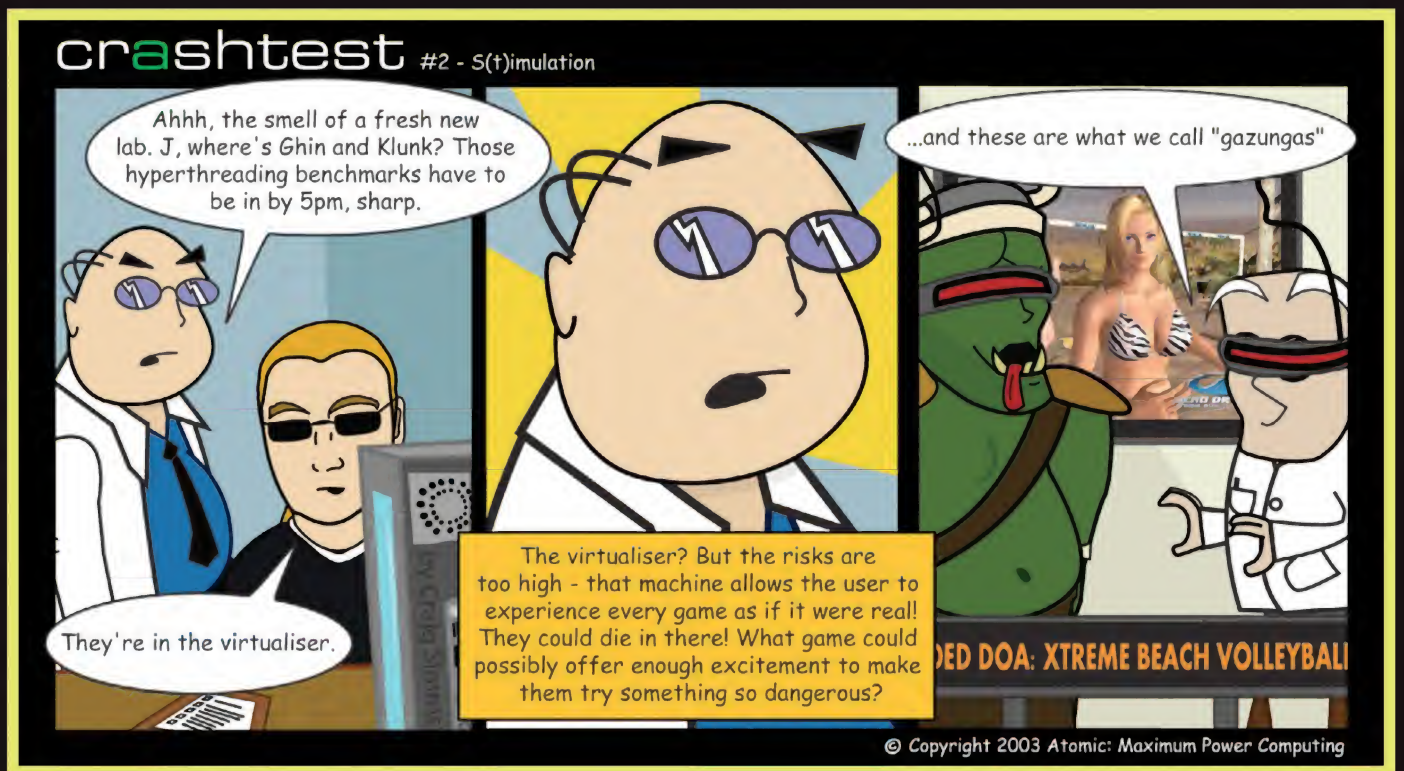
Sim citizen: That's no way to talk to your income earners! I've a right mind to go all pixilated and look poxy.

You: Hey, steady on there. No need to get all tough. How about I put a park here for you? Swings and all. . .

Sim citizen: You patronising bastard! Next you'll put a Sphinx downtown and expect us to go all 'oh isn't he wonderful'. Not likely, humey! What do you think we are? Stupid? We may be small, but we speak with a loud voice and carry nicely rendered sticks that can...

You: (Sighs quietly and constructs hospital on top of Sim. Games are so complicated these days, you think.)

First Deep Blue, then Deep Junior, then. . . the conquest of machines has begun. My advice? Start getting friendly with your toaster. In the coming battle we'll need all the allies we can get. . .



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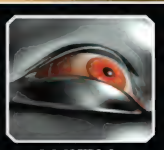
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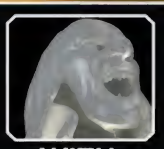
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